The hardest sudokus (new thread)

Re: The hardest sudokus (new thread)

by mith » Mon Mar 21, 2022 4:04 pm

Oh, sure. I posted this one because it's not in T&E(2).

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by mith » Mon Mar 21, 2022 4:42 pm

T&E depth 3 puzzles

This spreadsheet has all currently known non-T&E(singles,2) puzzles. There are three sheets:

expanded - All singles-expanded forms in gsf-minlex and solution-minlex, along with their SER (using gsf-minlex morph). I have ordered these based on ER (desc) and then clue count (desc). Also included is an ID which I will use for the database when I set it up - this ID will not change, though I will periodically re-order the spreadsheet based on ER and clue count. The final column, "246-ID", is the order in which the 246 expanded forms appeared in the Mar 16 post, since this order is referenced in Denis' tridagon analysis and subsequent posts.

minimal - All minimals of the puzzles in the expanded sheet, with the following information:

minimal_minlex - the gsf-minlex form of the minimal puzzle
db_puzzle - (hidden) empty for most; this holds the maxlex form for hendrik's contributions, and the Loki morph.
ER/EP/ED - SE ratings; if the puzzle was not in the database, these are blank, and if the puzzle was in the database but not yet rated these are 0.0.
skfr - (hidden) skfr ratings; if the puzzle was not in the database, these are blank.
c - clue count for the minimal
creator, name, rowid - name is hidden (currently only Loki is named), rowid is for the database with puzzles of that clue count (for unique determination, use both c and rowid); since the new puzzles haven't been added to the minimal database yet, they don't have a rowid yet.
expanded_minlex - the gsf-minlex form of the singles expansion
solution_minlex - the solution-minlex form of the singles expansion
ER/EP/ED - SE ratings for the expanded forms
ID - ID of the expanded form

The minimals are currently ordered by expanded form ID and then by clue count of the minimal. (When more puzzles are added and the expanded sheet is no longer sorted in ID order, the sorting here will adjust to match.)

Note that not all expanded forms have minimals associated with them - for example, ID 5 at 33c has minimals which only expanded as far as 32c. You can use the solution_minlex forms of the expanded puzzles to track these relationships. (I'll add some information on these relationships eventually, once I figure out how best to display that.)

previous IDs - These are the order in which expanded forms were previously posted; mostly to track the 246 puzzles mentioned above. I likely won't retain this information indefinitely, and it can easily be recreated anyway.

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by denis_berthier » Mon Mar 21, 2022 5:19 pm

Hi mith

Nice to see them all in a single place.
Is there a way to download the file?

denis_berthier
2010 Supporter
Posts: 3334
Joined: 19 June 2007
Location: Paris

Re: The hardest sudokus (new thread)

by mith » Mon Mar 21, 2022 6:09 pm

Most of the options are greyed-out because it's view-only, but you should still see a Download option under the "File" menu (top left).

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by xzccs » Wed Mar 23, 2022 12:23 pm

Hi all,

Inspired by the tridagon, I found a new pattern:

1. The triples in corner boxes form three rectangles.
2. On one side the triples in row and column meet at the same cell in the corner box, and on the other side they meet at different cells.

In this pattern, 123 can be deleted from X. In other word, it is a dead pattern if any one of these three cells is 123.

CODE: SELECT ALL
```
.-------------.-------------.-------------.
|         123 |             | 123         |
|     123     |             |     123     |
| 123         |     123     |         123 |
:-------------+-------------+-------------:
|             |             |             |
|     X  123  |      X      |     X  123  |
|             |             |             |
:-------------+-------------+-------------:
| 123         |     123     |         123 |
|     123     |             |     123     |
|         123 |             | 123         |
'-------------'-------------'-------------'
```

So, this extended is also a dead pattern.

CODE: SELECT ALL
```
.------------------.------------------.------------------.
|           123    |                  | 123              |
|       123        |                  |        123       |
| 123              |      123         |             123  |
:------------------+------------------+------------------:
|                  |                  |                  |
|     12345 123    |     12345        |     12345 123    |
|                  |                  |                  |
:------------------+------------------+------------------:
| 123              |      123         |             123  |
|       123        |                  |        123       |
|           123    |                  | 123              |
'------------------'------------------'------------------'
```

There are quite a few 10.0-10.5 puzzles generated from the following pattern.

CODE: SELECT ALL
```
35.....216.1...3.4.423.165...37....2....4......4..9..6.351.246.1.6...2.542.....13    ED=10.5/1.2/1.2
```

And I found two 11.1 running minimal in them.

CODE: SELECT ALL
```
.4.....26........5..25.413...37....4....6......4..9..1.152.3.4.2.6...5.3........2   ED=11.1/1.2/1.2
........55.1...2.3.6.5.314...37....4....2......4..9..6..51.463.........1.4.....52   ED=11.1/1.2/1.2
```

With the extended pattern, these 4 puzzles were found.

CODE: SELECT ALL
```
41.....356.3...2.4.253.461....7....1....6......4..9..2.365.214.2.1...5.654.....23   ED=9.5/9.5/3.4
41.....356.5...2.4.234.561....7....3....6......4..9..2.361.254.2.1...3.654.....21   ED=10.3/9.8/7.1
51.....343.4...2.6.264.351....7....2....6......1..9..3.321.564.6.5...3.114.....25   ED=10.3/9.8/7.1
51.....323.4...5.6.265.341....7....4....6......1..9..3.352.164.6.2...3.114.....25   ED=9.5/9.5/3.4
```

the minimal of them:

CODE: SELECT ALL
```
.1.....356.......4.253.4.1....7....1....6......4..9..2.3.5.214.2.....5.6.4.....23  ED=10.5/1.2/1.2
.1.....3.6.5...2...234.5.1....7....3....6......4..9..2.3.1.254...1.....654.....21  ED=10.4/1.2/1.2
51......43.........264.351....7....2....6......1..9..3.321.564.6.5...3...4.....2.  ED=10.4/1.2/1.2
.1.....323......5...265.341....7....4....6......1..9..3.352.164.6.......1.4.....25  ED=10.5/1.2/1.2
```

I wonder if we can find some harder puzzles with this pattern.

xzccs
Posts: 25
Joined: 02 January 2022
Location: Fiji

Re: The hardest sudokus (new thread)

by denis_berthier » Wed Mar 23, 2022 5:23 pm

.
Hi xzccs

All of these puzzles are (at most) in T&E(2).
I don't know if harder ones with the same pattern can be found, but the tridagon pattern already imposes heavy constraints on the positions of givens. Instead of 12 cells with 123 (a few ones with additional candidates), you have 16 cells with only 123. I think it doesn't leave much choice for the givens. But Sudoku always has some surprises in reserve. So let's see.

denis_berthier
2010 Supporter
Posts: 3334
Joined: 19 June 2007
Location: Paris

Re: The hardest sudokus (new thread)

by mith » Wed Mar 23, 2022 6:51 pm

> **xzccs wrote:**
> Hi all,
>
> Inspired by the tridagon, I found a new pattern:
>
> 1. The triples in corner boxes form three rectangles.
> 2. On one side the triples in row and column meet at the same cell in the corner box, and on the other side they meet at different cells.
>
> In this pattern, 123 can be deleted from X. In other word, it is a dead pattern if any one of these three cells is 123.
>
> CODE: SELECT ALL
> ```
> .-------------.-------------.-------------.
> |         123 |             | 123         |
> |     123     |             |     123     |
> | 123         |     123     |         123 |
> :-------------+-------------+-------------:
> |             |             |             |
> |     X  123  |      X      |     X  123  |
> |             |             |             |
> :-------------+-------------+-------------:
> | 123         |     123     |         123 |
> |     123     |             |     123     |
> |         123 |             | 123         |
> '-------------'-------------'-------------'
> ```

This pattern is actually a morph of one discussed on discord - the original version (proposed by Fryer) had an anti-diagonal pattern in all of b1379, and additional pattern cells in r17c5, r5c39, with variations following from that.

Along with the trivalue oddagon and shye's Patto Patto pattern, this is in the more general class of patterns which are not 3-colorable (with any one of your Xs as part of the pattern). I know ryokousha (also on discord) has been looking for more examples of these (he called this one "Fryer's Ring of Doom"), I'll consult with him and maybe start a thread in Advanced Solving Techniques about these patterns.

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by marek stefanik » Thu Mar 24, 2022 1:43 am

The two patterns are actually not isomorphic.
The argument I needed for xzccs' pattern was completely different (and I think more complicated) than for Fryer's pattern.

xzccs' pattern:
Step 1:

CODE: SELECT ALL
```
.-------------.-------------.-------------.
|        #123 |     -A      | 123         |
|     123-A   |     -A      |     123     |
|#123         |    #123     |         123 |
:-------------+-------------+-------------:
|             |     -A      |             |
|     X  123  |      X      |     X   A   |
|             |     -A      |             |
:-------------+-------------+-------------:
|#123         |    #123     |         123 |
|     123-A   |     -A      |     123     |
|        #123 |     -A      | 123         |
'-------------'-------------'-------------'
```

Let A be the digit in r5c9. There is a swordfish on A in complete triples: Ar37c3\c5b17.
Let B, C be the digits in r28c2, in that order. Note that all of A, B, C are different.
Already we can eliminate 123r5c2.

Step 2:

CODE: SELECT ALL
```
.-------------.-------------.-------------.
|         123 |             | 123         |
|     B       |             |     123     |
| 123         |    #123     |       #123-C|
:-------------+-------------+-------------:
|             |             |             |
|     X  123  |      X      |     X   A   |
|             |             |             |
:-------------+-------------+-------------:
| 123         |    #123     |       #123-B|
|     C       |             |     123     |
|         123 |             | 123         |
'-------------'-------------'-------------'
```

Br3c9 = (B–A)r3c5 =(1)= (A–C)r7c5 = Cr7c9

Step 3:

CODE: SELECT ALL
```
.-------------.-------------.-------------.
|         123 |             | 123         |
|     B       |             |     123     |
| 123         |     123     |         B   |
:-------------+-------------+-------------:
|             |             |             |
|     X  123  |     X-BC    |     X-BC A  |
|             |             |             |
:-------------+-------------+-------------:
| 123         |     123     |         C   |
|     C       |             |     123     |
|         123 |             | 123         |
'-------------'-------------'-------------'
```

With 2-string kites in complete triples Br7c3\r5c5b7, Cr3c3\r5c5b1 we can eliminate 123r5c5.
With ERs in complete triples Bc3b9\r59c8, Cc3b3\r15c8 we can eliminate 123r5c8.

Note that the minimal puzzles require one of the naked pairs in r19 and the following step before step 3:

CODE: SELECT ALL
```
.-------------.-------------.-------------.
|        1234 |             |#123         |
|     B  1234 |             |     123     |
| 123         |    #123     |         B   |
:-------------+-------------+-------------:
|             |             |             |
|     X  123  |     X-BC    |     X   A   |
|             |             |             |
:-------------+-------------+-------------:
|#123         |    #123     |         C   |
|     C       |             |     123     |
|        #123 |             |#123         |
'-------------'-------------'-------------'
```

even coloring chain Ar3c5 =(1)= r7c5 = r7c1 = r9c3 = r9c7 = r1c7 => r3c5 and r1c7 contain different digits
Whichever digit appears in r3c5 must appear in r1c3 in r1, hence -4r1c3.

Marek

marek stefanik
Posts: 269
Joined: 05 May 2021

Re: The hardest sudokus (new thread)

by mith » Thu Mar 24, 2022 1:42 pm

You're right, there's a key difference in how the b2468 cells connect via b1379 - in Fryer's example, the two digits in c5 are linking to the same rectangle of cells (top left position) in b1379, and likewise for r5 (bottom right position). In xzccs', c5 has the same connections but r5's cells do not (they are placed on different rectangles). Presumably this difference is what gives more restricted cells than just r5c5.

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by mith » Wed Mar 30, 2022 4:55 pm

Finally took care of my computer issues, so should be back to generating puzzles soon. (And working on the full update and expanded database, of course.)

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by hendrik_monard » Tue Apr 05, 2022 8:29 pm

70 new 11.8

CODE: SELECT ALL
```
98.76.5..7.5..98...64..8....976.4.5....95........87....76...4...4.....32...4...8.   11.8/1.2/1.2
98.76.5..7.5..98...645......976.4.5....95........87....76...4...4.....32...4...8.   11.8/1.2/1.2
987.........9.........65...84....32..93.2..47........84......9332....78..79...4.2   11.8/1.2/1.2
987......6..54.........8...8.9...63..23...9.7.......282.83...96.76...2.3.......7.   11.8/1.2/1.2
98.76.5..7.5..98...64......5......32.96...4.....4...8..796.4.5....95........87...   11.8/1.2/1.2
98.76.5..7.5.498...64......8.6....32.47...6.........5..796.4.8....95........87...   11.8/1.2/1.2
98.76.54.7.5.......6.8..7..8.6....9454....8.7..7...65.4.96.........394......2....   11.8/1.2/1.2
98.76.54.7.5.......6.8..7..8......9454...68.7..7...65.4.96.........394......2....   11.8/1.2/1.2
98.76.5..7.5.498...645......96...4...4.....32.......8..796.4.5....95........87...   11.8/1.2/1.2
98.76.5..7.5.498...645......796.4.8....95........87....47...6.....6....32.......5.   11.8/1.2/1.2
98.76.5..7.5..98...64..8....96...4...4.....32...4...8..796.4.5....95........87...   11.8/1.2/1.2
98.76.5..7.5..98...645......96...4...4.....32...4...8..796.4.5....95........87...   11.8/1.2/1.2
987......6..54.........8...89....63..2.....97..3...2.837....9.62..6..8....8....23   11.8/1.2/1.2
98.76.5..4.....5.7....4..9.6.5...67.9...9..86....8.7.54.3..8.....2.........5......   11.8/1.2/1.2
98.76.5..4.....5.7....4..9.6.5...67.9...95.86....8.7..4.3..8.....2.........5......   11.8/1.2/1.2
98.76.54.7.5.......4.5..8..8.4.96...56.8.7.....745....6.9...4......6...39.......2.   11.8/1.2/1.2
98.76....7.58.4....4....7..6.9...........532.........54.79.6....6..78.....854....   11.8/1.2/1.2
98.76.5..7.48..6...5..49...6..47....54.9...8..79.58........7.3........2.........8   11.8/1.2/1.2
987.........9.........65...8.....43..24....87..3...2.937....8.42...4.9...49....23   11.8/1.2/1.2
98.76.5..7.54..8...46.5....6.759....4..8.6.9...8.47....7.....3........2.........9   11.8/1.2/1.2
98.76.5..7...4.68......5..9.4..5.9.8...9...56...68.74..3...6....2.........4......   11.8/1.2/1.2
98.76.5..7.5....6..4..9.8..87....9.46.......85.5.4..67...83.........2..........4...   11.8/1.2/1.2
98.76.54.7.58...6..4...9...6..57....45.9..8...79.48........73........2..........8   11.8/1.2/1.2
98.76.54.7.5....6..4..9.8..87....9..6.4....85.5.4..67...83.........2..........4...   11.8/1.2/1.2
987......6..54.........8...7.....93.3.8....62.2.3..8..2.3....79.9....3.6..6...28.   11.8/1.2/1.2
987......6..54.........8...76....93.3.8....62.2.3..8..2.3....79.9....3.6......28.   11.8/1.2/1.2
98.76.5..7.54..86..4..5....6.759....4..8.6.9...8.47....7.....3........2.........9   11.8/1.2/1.2
98.76.5..7.5....9..46.9.8..87....94.6.......58.5.4..6.7..83.........2..........4...   11.8/1.2/1.2
98.76.54.7.5.9.8...46..8....6..45..7.49..8.....579.6.....9....3.........2.........7   11.8/1.2/1.2
987......6..54.........8...76....93.3.8....62.293..8..2.3....79.7....28.......3.6   11.8/1.2/1.2
98.76.5..7.48......56......8..9.6....7945.....6..8..5.....9..32....74..5......4..   11.8/1.2/1.2
98.76.5..7.48......56......8.59.6....7945.....6..8.........9..32....74.5.......4..   11.8/1.2/1.2
987......6..54.........9...8.....63..2.....87..3...2.937....8.62..6..9....9....23   11.8/1.2/1.2
98.76....7.5.84....46..9...4....75...79.5.6...6.94..8....8...3........2.........7   11.8/1.2/1.2
987.........9.........65...84....3...93.2..74..2....8.4......3932....7.8.79...42.   11.8/1.2/1.2
987......6..54.........8...8.9...63..23...9.7.......283......7.2.83...96.76...2..   11.8/1.2/1.2
98.76.5..7.5.......64.5....8.....4.....97..8.......53.26.9.47.5..7...6.4....89....   11.8/1.2/1.2
98.76.54.7.5.4.....6.8..7..8.6....945.....8.7..7...65.4.96.........394......2....   11.8/1.2/1.2
98.76.5..7..4..86..4...5.9.5....678....9.7.45...8..9.63...9....2.........5......   11.8/1.2/1.2
98.76.5..7..4..86..4...5.9.5....678....9.7.4....85.9.63...9....2.........5......   11.8/1.2/1.2
98.76.54.7.5.......4.5..8..8...96...56.8.7..4..745....6.9...4......6...39.......2.   11.8/1.2/1.2
98.76.5..7.5.498...645......976.4.5....95........87....76...4...4.....32.......8.   11.8/1.2/1.2
98.76.5..7.5.498...645......976.4.8....95........87....49...6.....6....32.......5.   11.8/1.2/1.2
98.76.5..7.54.98...46.5....6.75.....4..8.6.9..98.47....7.....3........2.........9   11.8/1.2/1.2
987......6..54.........8...7.....93.3.8....62.293..8..2.3....79.76...28.......3.6   11.8/1.2/1.2
987.........9.........65...84....93..23...8.7.......244.8...27.37..2..9..92...4.3   11.8/1.2/1.2
98.76.5..7.54.98....6....9.8.45.....69.8.7....57.46...4.8...93......46.........2.   11.8/1.2/1.2
98.76.5..7.54.98....6......69.8.7....57.46.8...45.....4.8...93......46.........2.   11.8/1.2/1.2
98.76.5..7.4.8.....569.48..8.....6...6.94...8..75..9.......5.746.....4.3.2........   11.8/1.2/1.2
98.76.5..7.5.49.....68.5...8.......9....5.834.......2..4..6.7.5..97..4.6....98....   11.8/1.2/1.2
98.76.5..7.5.84....64..97...58...49......5.3.2..........4..96.7...9.7......68.5...   11.8/1.2/1.2
987.........9.........65...89....43.2.4....87..3...2.973....8.44.9....23.2..4.9..   11.8/1.2/1.2
987.........9.........65...84....3...92....74..3.2..8.4......3932....7.8.79...42.   11.8/1.2/1.2
98.76....7.58.4....4....7..65..78...4.79.6.....854.....69...........532.........5   11.8/1.2/1.2
98.76....7.58.4....4..5.7..65..78...4.79.6.....8.4.....69...........532.........5   11.8/1.2/1.2
98.76.5..7.54...6..4...9.8.85.9..4..6.457.....79.8.........73........2..........4   11.8/1.2/1.2
98.76.5..7.54...6..4...9.8.85.9..4..6..57.....79.84........73........2..........4   11.8/1.2/1.2
98.76....7.58.4....46......8.49.6....795......6..8.4......9.32.....75.4.........5   11.8/1.2/1.2
987......6..54.........8...8.9...63..23...9.7.......283.8....962..3...7..76...2..   11.8/1.2/1.2
98.76.5..7.5..98...468......796.4.8....95........87....67...4....4....32...4....5.   11.8/1.2/1.2
98.76.5..7.5..98...46..5....796.4.8....95........87....67...4....4....32...4....5.   11.8/1.2/1.2
98.76.5..7.5.498...468......796.4.8....95........87....67...4....4....32.......5.   11.8/1.2/1.2
98.76.5..7.5.498...468......94...6...6.....32.......8..796.4.5....95........87...   11.8/1.2/1.2
98.76.5..7.5....6..4.5..8..8...96...5..8.7..4..745....6.9...4......6...39.......2.   11.8/1.2/1.2
98.76.54.7.5....6..4.5..8..8.4.96...5..8.7.....745....6.9...4......6...39.......2.   11.8/1.2/1.2
98.76.54.7.5.4.....6.8..7..6.8....945.....6.7..7...85.4.96.........394......2....   11.8/1.2/1.2
98.76.54.7.5.......6.8..7..6.8....9.5.....6.7.47...85.4.96.........394......2....   11.8/1.2/1.2
98.76.5..7.5.......64.5....6...47.5..78..6.4.....98.....9....4.....87..9......53.2   11.8/1.2/1.2
98.76.54.7.5.......6.8..7..5......6.7.47..685...8....9.4.96.........394......2....   11.8/1.2/1.2
98.76.5..4.7...68...5.4..9.7......4565....8.9..8...76..9.3........29.........4...   11.8/1.2/1.2
```

and 770 11.7 (hidden)

Hidden Text: Show

hendrik_monard
Posts: 50
Joined: 19 April 2021
Location: Leuven (Louvain) Belgium

Re: The hardest sudokus (new thread)

by hendrik_monard » Tue Apr 05, 2022 8:31 pm

and a collection of 11.6

Hidden Text: Show

hendrik_monard
Posts: 50
Joined: 19 April 2021
Location: Leuven (Louvain) Belgium

Re: The hardest sudokus (new thread)

by denis_berthier » Wed Apr 06, 2022 11:49 am

> **hendrik_monard wrote:**
> 70 new 11.8

Hi Hendrik,
Good finds.

Some puzzles (44) are in T&E(2): 3 4 13 14 15 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 39 40 44 45 46 47 48 49 50 51 52 52 54 55 56 57 58 59 70
The rest is in T&E(W2, 2).

Whether in T&E(2) or not, all the puzzles have a Tridagon elimination rule.
For a more detailed analysis based on Tridagons, see the Tridagon thread: http://forum.enjoysudoku.com/the-tridagon-rule-t39859.html

denis_berthier
2010 Supporter
Posts: 3334
Joined: 19 June 2007
Location: Paris

Re: The hardest sudokus (new thread)

by mith » Thu Apr 07, 2022 4:56 pm

As mentioned elsewhere, I have finally got some searches back up and running, now focused only on T&E depth. I may start a new thread for tracking these puzzles.

Anyway, while the generating is only based on whether they have depth 3, I am running SE on the expanded forms, and after finding a bunch of 11.7s I finally got a couple 11.8s. Here are their minimal forms:

CODE: SELECT ALL
```
........1.......23....45.....1.54....4671.8..75.8.61...67......18.......5.4.78..6  ED=11.8/1.2/1.2
........1.......23....45.....1.54....467.18..75.86.1...67......18.......5.4.87..6  ED=11.8/1.2/1.2
```

The total count for expanded forms not in T&E(2) is now 1808 + any from hendrik's latest batch which I haven't incorporated yet. The count of minimals is 4513 (more than double what I had in the google doc).

I am currently running three scripts:

1. For each minimal puzzle, generate all puzzles in the following neighborhoods: {-2,+2}, {-1,+2}, {-2,+1}. Then check T&E depth, and if >2 expand and check against the expanded puzzle database.
2. For each expanded puzzle, generate all "transforms" obtained by swapping groups of disconnected givens and check against the expanded puzzle database.
3. For each expanded puzzle, generate all minimals, check against the minimal puzzle database; also expand and check against the expanded puzzle database.

The first script is easily the slowest of the three (it has gotten through 939 of the 4513 minimals so far), and I will be splitting it into multiple threads at some point. A fourth script will be adding digits to expanded puzzles and checking depth, eventually yielding all the "maximal" expanded forms for every puzzle in the database.

The lowest rated expanded form in the database so far is:

CODE: SELECT ALL
```
........1.....234.....56.7.....8.......6.928..6821..9..59..1..86.29.8..581.5.....  ED=9.2/4.5/2.6
```

(Without uniqueness techniques, it jumps to 11.6.)

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by denis_berthier » Fri Apr 08, 2022 4:04 am

> **mith wrote:**
> The total count for expanded forms not in T&E(2) is now 1808 + any from hendrik's latest batch which I haven't incorporated yet. The count of minimals is 4513 (more than double what I had in the google doc).

When you integrate Hendrik's puzzles into the expanded database, could you have a temporary index corresponding to their place in Hendrik's original sequence, as you did with my numbering of some version of yours?

> **mith wrote:**
> 2. For each expanded puzzle, generate all "transforms" obtained by swapping groups of disconnected givens and check against the expanded puzzle database

This is probably where much "hidden" redundancy is introduced. "Hidden", I mean by quasi isomorphisms. AFAIK, this technique of expansion wasn't used in the previous database, and that would explain why we didn't have the redundancy problem. I don't mean you shouldn't do it; it's great for exploring a puzzle neighbourhood; just try to understand the why.

> **mith wrote:**
> The lowest rated expanded form in the database so far is:
> CODE: SELECT ALL
> ```
> ........1.....234.....56.7.....8.......6.928..6821..9..59..1..86.29.8..581.5.....  ED=9.2/4.5/2.6
> ```
> (Without uniqueness techniques, it jumps to 11.6.)

I'd count it as 11.6. Uniqueness makes a total mess when it comes to establishing any relationship with T&E-depth.
I'm curious to see what's the "real" min SER without uniqueness.

denis_berthier
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