The hardest sudokus (new thread)

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Re: The hardest sudokus (new thread)

by **mith** » Thu Mar 03, 2022 6:46 pm

> **yzfwsf wrote:**
> Are the following backdoor of size 2 combinations considered T&E (Single, 2)?

My understanding is that backdoor size does not correlate directly to T&E as defined by Denis.

> from https://arxiv.org/ftp/arxiv/papers/1304/1304.3210.pdf
>
> *But notice nevertheless that*
> *it includes no "guessing": if a solution is obtained in an*
> *auxiliary state KS', then it is not taken into account, as it*
> *would in standard structured search algorithms.*

That is, T&E(2) will eliminate candidates based on contradictions, but it will do nothing if reaching an end state with no contradiction (even if that end state is a solution - determining that this is the only solution would amount to assuming uniqueness).

mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by **denis_berthier** » Thu Mar 03, 2022 7:06 pm

> **yzfwsf wrote:**
> Are the following backdoor of size 2 combinations considered T&E (Single, 2)?

No. Solving a puzzle using a backdoor-pair is guessing.
T&E relies on eliminating candidates, not on guessing solutions.
Now, if you want a definition of T&E, there's no way you can avoid reading it.

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

Re: The hardest sudokus (new thread)

by **hendrik_monard** » Thu Mar 03, 2022 7:31 pm

> **denis_berthier wrote:**
>
> As far as I can remember, we had concluded that your solver is equivalent to:
> - T&E(S4, 0) = S at stage 1
> - T&E(S4, 1) at stage 2
> - T&E(S4, 2) at stage 3
> - T&E(S4, 3) at stage 4
> .

Hi Denis,
I don't think that a clear parallel can be drawn between our two analysis concepts. (I posted a description of my process on October 1st).
As I only use this solver occasionally, I never tried it on a larger group of puzzles. It could be interesting to examine the results it delivers for the preliminary full list of 11.9s and 11.8s posted by mith on February 2nd.
I intend to write a short program for that purpose. As I have a busy day tomorrow, I shall deal with this during the weekend and report afterwards.

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

Re: The hardest sudokus (new thread)

by **denis_berthier** » Fri Mar 04, 2022 5:24 am

> **hendrik_monard wrote:**
> I don't think that a clear parallel can be drawn between our two analysis concepts. (I posted a description of my process on October 1st).

Hi Hendrik,
I can't be 100% sure, because many things may be hidden in programming details.
But I re-read your post and our subsequent discussion; and it seems to me that your procedure is equivalent to my definition of T&E(S4, n), with the correspondence as in my previous post.
At least if you apply the results of each level before starting a new one (that's the point that remains unclear to me in your current process).

BTW, I was so surprised of seeing a puzzle not in T&E(2) that I re-did an intensive check of my implementation of T&E(2); but I found it was fully compliant with my formal definitions in [CRT] or [PBCS].
These precise definitions are essential to all my T&E(T) vs T-braids theorems. Those theorems in turn are essential for the practical computation of the BpB classification.
T&E is a general procedure at the same level as BFS or DFS, but radically different from both.

Looking forward for your report.

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

Re: The hardest sudokus (new thread)

by **DEFISE** » Sat Mar 05, 2022 10:17 am

> **denis_berthier wrote:**
> BTW, I was so surprised of seeing a puzzle not in T&E(2) that I re-did an intensive check of my implementation of T&E(2); but I found it was fully compliant with my formal definitions in [CRT] or [PBCS].

Hi Denis,
I haven't followed all your discussions in detail but I checked that:
1) Loki puzzle is not in T&E(S4,2) S4 including naked, hidden and super-hidden. You did too I believe.
2) Loki puzzle is solvable in T&E(3) (in 17 steps).

DEFISE
Posts: 221
Joined: 16 April 2020
Location: France

Re: The hardest sudokus (new thread)

by **denis_berthier** » Sat Mar 05, 2022 11:11 am

> **DEFISE wrote:**
>
> > **denis_berthier wrote:**
> > BTW, I was so surprised of seeing a puzzle not in T&E(2) that I re-did an intensive check of my implementation of T&E(2); but I found it was fully compliant with my formal definitions in [CRT] or [PBCS].
>
> I haven't followed all your discussions in detail but I checked that:
> 1) Loki puzzle is not in T&E(S4,2) S4 including naked, hidden and super-hidden. You did too I believe.
> 2) Loki puzzle is solvable in T&E(3) (in 17 steps).

Hi François
Yes. Same results.
Thanks for checking. It's always better to have independent checks when something so surprising happens.

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

Re: The hardest sudokus (new thread)

by **mith** » Sat Mar 05, 2022 5:56 pm

Nothing too exciting for today's update; 11.7s are from 26c-27c, and 11.6s are from 27c-29c;31c.

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mith
Posts: 862
Joined: 14 July 2020

Re: The hardest sudokus (new thread)

by **hendrik_monard** » Sun Mar 06, 2022 4:42 pm

> **denis_berthier wrote:**
> Looking forward for your report.

Hi Denis,
I checked my Solver (with the 4 'stages') and made sure that the available information (solved cells and removed candidates) is each time transferred to the next stage.
It appears that the lists of puzzles treated with this solver in the past contained mostly puzzles with relatively low clue counts. They were solved at stage 3 or lower, including the 'old' 11.9s and 11.8s. That's why until today I thought that puzzles needing stage 4 to get solved were very rare.
Great was my surprise to see that in the batch of 348 11.8+ posted by mith on February 2nd, almost all puzzles with 25 or more clues needed stage 4 to get solved. As stage 4 mostly takes a long time, I halted the operation after 120 puzzles. The first in the list needing stage 4 were the new 11.9 of mith and his 11.8 on the next line
I repeated the test on recent batches of 11.7s and 11.6s with clue counts >= 25. Stage 4 was also needed for the overwhelming majority of them.

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

Re: The hardest sudokus (new thread)

by **denis_berthier** » Sun Mar 06, 2022 5:19 pm

Hi Hendrik,
So, your solver is probably not doing the same thing as T&E(S, n), after all.
I'm surprised that the clue count can play any role wrt the necessary stage.

I've been busy with other things and I haven't yet checked the last large batch of 11.8s after Mith's 11.9; but all the puzzles known before this 11.9 could be solved in T&E(2).

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

Re: The hardest sudokus (new thread)

by **marek stefanik** » Sun Mar 06, 2022 7:13 pm

Hi Hendrik and Denis,

I believe I can explain the difference.

> **hendrik_monard here wrote:**
> In stage 3, the process is similar to the one of stage 2. However, in this stage candidates of two cells are combined. If a candidate of cell x combined with each candidate of cell y results every time in an error returned by the basic solver, that candidate of cell x can be eliminated, because one of the candidates of cell y has to be part of the ultimate solution of the puzzle.

Whereas in T&E(2) the entire T&E(1) procedure is used to get a contradiction.

To demonstrate:

CODE: SELECT ALL

```
.-----------------.-----------------.-----------------.
| 12 +  123+  12 + | 12 +  123+  12 + | 123+  123+  12 + |
|  23+  12 +   23+ |  23+  123+   23+ |  2 +   2 +   23+ |    + stands for 456789
| 123+  12 +  123+ | 123+  123+  123+ | 12 +  12 +  123+ |
:-----------------+-----------------+-----------------:
| 1234  123+     + | 123+  123+  123+ | 12 +  12 +  123+ |
| 123+  123+  123+ | 123+  123   123+ | 123+  123+  123+ |
|   3+  12 +    3+   123+  123+  123+ | 123+  123+  12 + |
:-----------------+-----------------+-----------------:
| 123+  12 +  123+ | 123+  123+  123+ | 123+  123+  12 + |
| 1 3+  12 +  1 3+ | 1 3+  123+  1 3+ | 1 3+  1 3+  1  + |
| 123+  12 +  123+ | 123+  123+  123+ | 123+  123+  12 + |
'-----------------'-----------------'-----------------'
```

The sukaku string: Show

4r4c1 can be eliminated using T&E(2):
Suppose 4r4c1.
each of 12r5c5 -> contra. with singles, hence 3r5c5
each 3 in r1 -> contra. with singles
Therefore -4r4c1.

But I believe that stage 3 of Hendrik's solver cannot prove the elimination, as I think that 12r5c5 are the only two candidates that together with 4r4c1 give a contradiction with basics.

I think there is one more difference – basics aren't equivalent to subsets, as basics don't include basic fish.

Marek

marek stefanik
Posts: 269
Joined: 05 May 2021

Re: The hardest sudokus (new thread)

by **hendrik_monard** » Sun Mar 06, 2022 9:35 pm

Hi Denis and Marek,

I think that Marek is right. I have again tested the first 132 puzzles of mith's preliminary overview of 11.9s and 11.8s, but this time I enabled in my basic solver two extra strategies on top of the basic strategies (hidden and naked singles, pairs, triples and quads, claiming and pointing). The two extra strategies are X-Wing and Turbot fish, and they are the only ones I programmed above the basic ones when I built my basic solver some years ago.
While in the first run, on which I reported in my previous post, there were 53 puzzles needing stage 4, in the new run (with extended basic solver as just explained) this number was reduced to 34.

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

Re: The hardest sudokus (new thread)

by **denis_berthier** » Mon Mar 07, 2022 5:33 am

.
Hi Hendrik and Marek

Easy things first. Adding Fishy patterns to the other Subsets will obviously allow to solve more puzzles at each "stage".
However, in the Mith's 11.9 (Loki) case, this can't explain any difference, because Subsets (in my sense: Naked, Hidden and Super-Hidden) play no role in it. The resolution state after T&E(Subsets, 2) is exactly the same as after T&E(Singles, 2) and moreover exactly the same as after T&E(B6, 1).

Conclusion: Hendrik's algorithm is missing some T&E(n) eliminations at some level n.
If you want to check each level, here are the

CODE: SELECT ALL

```
Resolution state after T&E(Singles, 1):
   +----------------------+----------------------+----------------------+
   ! 3459   24569  45789  ! 4569   4579   4589   ! 23789  236789 1      !
   ! 13459  4569   45789  ! 14569  4579   2      ! 3789   36789  3679   !
   ! 19     269    789    ! 169    3      189    ! 2789   4      5      !
   +----------------------+----------------------+----------------------+
   ! 8      459    6      ! 23     459    145    ! 234579 123579 23479  !
   ! 459    7      1      ! 23     8      459    ! 23459  23569  23469  !
   ! 2      3      459    ! 1459   6      7      ! 459    159    8      !
   +----------------------+----------------------+----------------------+
   ! 459    8      2      ! 7      459    6      ! 1      359    349    !
   ! 6      1      459    ! 459    2      3      ! 45789  5789   479    !
   ! 7      459    3      ! 8      1      459    ! 6      259    249    !
   +----------------------+----------------------+----------------------+
197 candidates
```

and (already published in some of the previous posts):

CODE: SELECT ALL

```
Resolution state after T&E(Singles, 2) or  after T&E(S4, 2):
+----------------+----------------+----------------+
! 3    256  478  ! 459  4579 4589 ! 27   68   1    !
! 145  456  458  ! 156  47   2    ! 39   678  39   !
! 19   269  79   ! 16   3    18   ! 278  4    5    !
+----------------+----------------+----------------+
! 8    459  6    ! 23   459  14   ! 4579 1237 237  !
! 459  7    1    ! 23   8    459  ! 3459 235  6    !
! 2    3    459  ! 1459 6    7    ! 459  19   8    !
+----------------+----------------+----------------+
! 459  8    2    ! 7    459  6    ! 1    359  34   !
! 6    1    459  ! 459  2    3    ! 58   5789 47   !
! 7    459  3    ! 8    1    459  ! 6    259  249  !
+----------------+----------------+----------------+
141 candidates
```

> **marek stefanik wrote:**
>
> > **hendrik_monard here wrote:**
> > In stage 3, the process is similar to the one of stage 2. However, in this stage candidates of two cells are combined. If a candidate of cell x combined with each candidate of cell y results every time in an error returned by the basic solver, that candidate of cell x can be eliminated, because one of the candidates of cell y has to be part of the ultimate solution of the puzzle.
>
> Whereas in T&E(2) the entire T&E(1) procedure is used to get a contradiction.

I'm not sure what you mean here. If T&E(1) has been fully applied before starting T&E(2), what Hendrik describes above seems to be equivalent to T&E(some subsets, 2) applied to x. But as I said previously, many things depend on details. Without a full pseudo-code for the process, it will remain difficult to find where the difference really occurs.

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

Re: The hardest sudokus (new thread)

by **denis_berthier** » Mon Mar 07, 2022 8:31 am

.
I've made a review of all mith's 11.8 puzzles wrt to T&E(2).
As they are scattered in several pages, I can't be sure I haven't missed anything.

Below, they are grouped in 4 series. In the absence of any name or number, I had numbered the first of them for my personal use.
It is still unclear to me whether puzzles from different series can be equivalent after applying Singles and minlexing.

Series 1: I had started computing their BpB classification; it is therefore included in the below list (a - sign such as in B5B- means in B5B or less). This implies they are all in T&E(2).

CODE: SELECT ALL

```
.....9.......8..76...7...85..5.....7.9.....5.1....23...1...4...34..9......681....;11.8;11.8;2.6; mith11.8#1; B5B-
........1.......2...3..45......6...7..5..8....9.3..4...39..58...8.9.....2...1..7.  ED=11.8/1.2/1.2; mith11.8#2; B5B-
........1....23.....45...2...3..5.6..6....1..78.6....9..6.5.....1.4....89.....7..  ED=11.8/11.8/2.6 (DCFC+DFC); mith11.8#3; B6B
........1.....234..34....2.......1.5.....3.6....15...7.68..4...7...9....9..5....3  ED=11.8/11.8/2.6; mith11.8#4; B5B-
........1....12.....34...5.....6...2.7....53..8.5..4...378.....1....9...94....7..  ED=11.8/1.2/1.2; mith11.8#5; B5B
........1.....2.34....3.56...2.64....7.8.....8..9....6..5....4..8....1.771......9  ED=11.8/11.8/2.6; mith11.8#6; B5B-
........1.....2.34....3.56...2.46....7.8......8.9....6..5....4.71......98.....1.7  ED=11.8/11.8/2.6; mith11.8#7; B5B-
........1.....2.34....3.56...2.46....7.8.....8..9....6..5....4..8....1.771......9  ED=11.8/11.8/2.6; mith11.8#8; B6B
........1.....2.34....3.56...2.46....7.8.....8..9....6..4....5.18......77.....1.9  ED=11.8/11.8/2.6; mith11.8#9; B5B-
........1.....2.34....3.56...2.46....7.8......8.9....6..4....5.71......98.....1.7  ED=11.8/11.8/2.6; mith11.8#10; B5B-
........1......23......4..5...26.....23.784..86.4.3....7.63....34.8.2...6.2..7.8.  ED=11.8/1.2/1.2 mith11.8#11; B6B-
........1......23......4..5...26.....23.784..86...3....7.6.....34.8.2...6.2.47.8.  ED=11.8/1.2/1.2 mith11.8#12; B6B-
........1....23.....45...6...5..17...7.8...5.9....5..3.56....7..8.4.....2.......9  ED=11.8/1.2/1.2 mith11.8#13; B6B-
........1.......2.....13.45...3.56....5.78....3716.....6.73...8.785.1...3.1.86.5. ED=11.8/1.2/1.2 mith11.8#14; B6B-
........1.......2.....13.45...3.56...371.....6.5.78....6.73...8.785.1...3.1.86.5. ED=11.8/1.2/1.2 mith11.8#15; B6B-
........1.......2.....13.45...3.56....5.78....3716.5...785.1...3.1.86...56.73...8 ED=11.8/1.2/1.2 mith11.8#16; B6B-
........1.......2.....13.45...3.56...371..5..6.5.78....785.1...3.1.86...56.73...8 ED=11.8/1.2/1.2 mith11.8#17; B6B-
........1.....2.3...4.5.6....748.....3...1..84.85......4....7...9.....237...6.8..  ED=11.8/11.8/2.6 mith11.8#18; B6B-
........1.....2.3....45.6....3....7..4..6....5..8..9....7..1..2.8.6..5..9...4....  ED=11.8/1.2/1.2 mith11.8#19; B6B-
```

Series 2: I had planned to compute their BpB classification and numbered them, but in the meantime mith discovered the first 11.9 not in T&E(2). So I set up for just checking which of them fails to be in T&E(2)

CODE: SELECT ALL

```
........1.......2......3..4..2..56...37.682...5.27.8...2673....3.58.6...78..5.... ED=11.8/1.2/1.2 mith11.8#20
........1.......2......3..4..2..56...37.682...5.27.8...2673.....8..5....3.58.6.7. ED=11.8/1.2/1.2 mith11.8#21
........1.......2......3..4..2.356.7.3.6.82...5.72.8...26.7....3.5.86...78.5..... ED=11.8/1.2/1.2 mith11.8#22
........1.......2......3..4..2.356...376.82...5.72.8...26.7....3.5.86...78.5..... ED=11.8/1.2/1.2 mith11.8#23
........1.......2......3..4..2.356...376.82...5.72.8...26.7.....8.5.....3.5.86.7. ED=11.8/1.2/1.2 mith11.8#24
........1.....2.......3..45..1.23....267.81..73.61.8...17.6.....8.......2.3.87..6 ED=11.8/1.2/1.2 mith11.8#25 not in T&E(2)
........1.......2......3..4..2..56.7.3..682...5.27.8...2673....3.58.6...78..5.... ED=11.8/1.2/1.2 mith11.8#26
........1.......2......3..4..3.5.2....627.8...8...65.7.78.6....5.273....63.8.5... ED=11.8/1.2/1.2 mith11.8#27
........1.......2......3..4..5..67...6.28.5..83..7.2...58.6....6.35.7...72.83.... ED=11.8/1.2/1.2 mith11.8#28
........1.......2......3..4..5..67...6.28.5..83..7.2...5..6....6.35.7.8.72.83.... ED=11.8/1.2/1.2 mith11.8#29
........1.......2......3..4..3.5.2....627.8...8.3.65.7.78.6....5.27.....63.8.5... ED=11.8/1.2/1.2 mith11.8#30
........1.......2......3..4..5.367...6.82.5..83.7..2...586.....6.3.57...72..8.... ED=11.8/1.2/1.2 mith11.8#31
........1.......2......3..4..5.367...6.82.5..83.7..2...5.6.....6.3.57.8.72..8.... ED=11.8/1.2/1.2 mith11.8#32
```

#5 is known to be equivalent to Loki after applying Singles and minlexing.

Series 3 is what came immediately after the discovery of Loki. It contains only the 74 minlexed expanded (by Singles) forms of the 146 puzzles. As T&E(n) is invariant under isomorphisms and under application of Singles, this is enough.

CODE: SELECT ALL

```
.......12....13..4..12..5....46....5.7....6..86..9......64...5..9...7...3...8.... 23c
........1.....2.......3..45.16.23...27.8.61..3.871.6...32.68..718..7....6.7...... 29c not in T&E(2)
........1.......2...3..45......6...7..5..8....9.3..4...39..58...8.9.....2..81..7. 22c
........1.....2.3....14.5....2....6..3......78..9..4...68..7...4..81....9...5.8.. 22c
........1.....2.3...4.5.6.....7...8...6.9...5.2...3....7.8.9...6...1...99.1...4.. 22c
........1..2..3.4..5..6.7.......1.8....4....32...9.6....9.2.5..56.8.....72....... 22c
.......12....13.4...14..5....2.....5.3..6....7....8.....41...5..6..3.9..8....7... 22c
.....1..2....3..4....5..6....1..2....7......89...4.3...98.....73..9...5.5...6.9.. 22c
........1.....2.3....14.5....3.....6.7.....828..9..1...86..7...4..89....5...1.8.. 23c
........1.....2.3....45.6....1.7..62.8.6..7..67.........3..9...4..5..8..85.7..... 23c
........1.....2.3...4.5.6...16....27.4....8..8...6.9...7...3...4.58.....6..59.... 23c
........1.....2.3...4.5.6...16....72.4....8..8...6.9...7...3...4.58.....6..59.... 23c
........1.....2.3...4.5.6...3...1...4.78.....6..54.....4....7...96....127...6.8.. 23c
........1.....2.3...4.5.6...37....82.4....7..6..7..9...8...1...4.56.....7..59.... 23c
........1....12....134...5.....6...2.7....53..8.5..4...378.....1....9...94....7.. 23c
........1....23.....45...6...5..17...7.8...5.9....5..3.56....7..894.....2.......9 23c
........1..2..3.4..4..5.6.....36...5.3.1..7..2....8.3...9.3...7.2...4.9.8........ 23c
........1..2..3.4..4.15........6.15..5.7..48.8.......9..3..2....7..1.6..9.......8 23c
........1..2..3.4..5..6.7.......1.3....4....85...7.2....5.2.9..29.....8.76.9..... 23c
.......12.....3..4..4.2.5....2.6...5.7....6..86.9.......6.1..5..9...8...3..7.6... 23c
.......12....13..4..14..5....26...5..7....6..8...9.4....41....5.3..8....9....7... 23c
.......12....13.45..14..6....45....1.7....2..8...9......61...2..9..8....3....7... 23c
.....1..2....2..3....24..5....1..46...7......38......9...6.4.....3.6....79..5...86 23c
.....1..2..2....3..4..5.6.......7.16.8..6....6..5..9....3..5..7.5.8.....9...4.5.. 23c
........1.....2.3...4.5.6.....3.7.8..6..1.7.3.7....1.4.46.7....28...9...9..8..... 24c
........1.....2.3..34.5..2.....35..6.652...4.7...46......5..8...52..4.6.9........ 24c
........1..1..2.3..4..5.2.......6.....37...2686....9....6..7..2.5.4..6..9...6..8. 24c
.......12..1..3.4..4..1.5....6..7....2..4...58..3.......7.98....9..3..5.3..6..9.. 24c
........1.....2.....3.4..5.....3.5.4..5..67.3.3.....6..87.64.3.3.6.5..4.9..8.3... 26c
........1......23......4..5...26.....23.784..86.4.3....786.....34.8.2...6.2.47.8. 28c
..............1.23...45.6.1..1.47....7681...584...6..7.5478....6.81..7..7...6.... 29c
..............1.23...45.6.1..1.47....7681..5.84...6..7.5478....6.81..7..7...6.... 29c
........1......23......4..5...26.....23.784..86.4.3....7863....34.8.2...6.2.47.8. 29c
........1......23......4.56....43..5.3752..8.5.47.8.2...84.....34..87...7.235.... 29c
........1......23.....14.56..7..6....86.5...741..78.....864..7..547.1...76..85... 29c
........1.......2......3..4.25.367..3.782.5..68.7.52...63.57...27.38....5.86..... 30c
........1.......2......3..4.25.367..3.87.52..67.82.5...63.57...2.738....58.6..... 30c
........1.......2......3..4.25.367..37.82.5..6.87.52...63.57...2.738....58.6..... 30c
........1.......2......3..4.25.367..38.7.52..6.782.5...63.57...27.38....5.86..... 30c
........1......23....24.....564.7...847.2...67..85....4625....5.74.8.6.82..67... 30c
........1.....2.34.35.......62......7.3.25..885...67...7853....32..68...5.62.7.8. 30c  not in T&E(2)
........1.....234.....56.7...65.87...25.17...87.62.....682....72.7.6....51.87.... 30c
..............1.23...45.6.1..7.6.....861..7..54.78.....15.47...4.85.6..776.81...4 31c
..............1.23...45.6.1..7.6.....861..7..54.78.....15.47...4.85.6..776.81..4. 31c
..............1.23.14...5.6..5..7....6..857...7841.....8675...154.1.8..77.1.64... 31c
..............1.23.14...5.6..5..7....6..857...7841.....8675...454.1.8..77.1.64... 31c
..............1.23.14...5.6..5..7....6..857...7841.....8675..1.54.1.8..77.1.64... 31c
..............1.23.14...5.6..5..7....6..857...7841.....8675..4.54.1.8..77.1.64... 31c
........1.......2......3..4.25.367.83.782.5..68.7.52...63.57...27.38....5.86..... 31c
........1.......2......3..4.25.367.83.87.52..67.82.5...63.57...2.738....58.6..... 31c
........1.......2......3..4.25.367.837.82.5..6.87.52...63.57...2.738....58.6..... 31c
........1.......2......3..4.25.367.838.7.52..6.782.5...63.57...27.38....5.86..... 31c
........1......23......4.56..7.4.....8253....43.7.8....54.87.2.27.4.3..53.825..7. 31c
........1......23.....14.56..71.6....8645...741..78.....864..7..547.1...76..85... 31c
........1.....234.....56.7...187.....862.5..727..61....52.17....6.5.87..8.762.... 31c
..............1.23...45.6.1..7.64....861.57..54.78.....15.47...4.85.6..776.81.... 32c
..............1.23...45.6.1..7.65....861.47..54.78.....15.47...4.85.6..776.81.... 32c
..............1.23..4.2.56...7.13....8324...714.7.8....21.74...4.813..7.73.8.2... 32c
..............1.23..4.2.56...7.43....8321...714.7.8....21.74...4.813..7.73.8.2... 32c
..............1.23.14...5.6.7658....54..17..88.16.4....8714....1.5..8...46.7.58.. 32c
..............1.23.14...5.6.7658....54..17..88.16.4....8714....16.7.58..4.5..8... 32c
........1.......2......3..4.2356.7..5.82.76..67..382.5.578....22.635....83..72... 32c
........1.......2......3..4.2356.7..5.82.76..76..382.5.578....22.635....38..72... 32c
........1.......2......3..4.25.36...37.8.52.66.872.5...63.58.7.28.67....5.73...6. 32c
........1.......2......3..4.25.367.83.782.5..68.7.52...63.57.8.27.38....5.86..... 32c
........1.......2......3..4.25.367.83.87.52..67.82.5...63.57.8.2.738....58.6..... 32c
........1.......2......3..4.25.367.837.82.5..6.87.52...63.57.8.2.738....58.6..... 32c
........1.......2......3..4.25.367.838.7.52..6.782.5...63.57.8.27.38....5.86..... 32c
........1.......2.....13.45...3.56...3716.5..6.5.78....785.1...3.1.86.5.56.73...8 32c
........1.......2......3..4.2356.7..5.82.76.367..382.5.578....22.635....83..72... 33c
........1.......2......3..4.2356.7..5.82.76.376..382.5.578....22.635....38..72... 33c
........1......23......4.56..7.42....8253....43.7.8..2.54.87.2.27.4.3..53.825..7. 33c
........1.....2.34..2...56..23.78.5.5.82.6...67.53..8..5736.....8..25...2.68.7..5 33c
........1.......2......34.5.26.37..434.8.62.78.742.6...73.68.4.28.74....6.43...7. 34c
```

Notice there are 2 puzzles not in T&E(2). Here are their respective resolution state after applying T&E(2).

CODE: SELECT ALL

```
PUZZLE 2 IS NOT SOLVED. 50 VALUES MISSING.
Final resolution state:
   478        256        3          459        4589       4579       28         67         1
   457        456        145        156        48         2          39         678        39
   89         269        19         16         3          17         278        4          5
   459        1          6          459        2          3          57         5789       48
   2          7          459        8          459        6          1          359        34
   3          459        8          7          1          459        6          259        249
   459        3          2          1459       6          8          459        19         7
   1          8          459        23         7          459        3459       235        6
   6          459        7          23         459        14         4589       1238       238
```

CODE: SELECT ALL

```
PUZZLE 41 IS NOT SOLVED. 50 VALUES MISSING.
Final resolution state:
   2469       489        479        3678       478        39         256        25         1
   16         18         179        678        5          2          89         3          4
   24         3          5          1469       1489       149        89         67         267
   149        6          2          78         78         1349       345        149        35
   7          149        3          149        2          5          16         1469       8
   8          5          149        13         149        6          7          1249       23
   149        7          8          5          3          149        124        126        69
   3          2          149        149        6          8          145        457        579
   5          149        6          2          149        7          134        8          39
```

Series 4 is what came after the 3rd. It's unclear to me if they are related to previous puzzles, ut anyway, they're all in T&E(2).

CODE: SELECT ALL

```
........1......23......4.56....43..5.3752..8.5.47.8.2...8......34..87...7.235....   ED=11.8/1.2/1.2
........1......23.....14.56..7..6....86.5...741..78.....864..7..54..1...76..85...   ED=11.8/1.2/1.2
........1......23......4.56.....3..5.3725..8.5.4.78.2...8.4....34.8.7...7.253....   ED=11.8/1.2/1.2
........1......23.....14.56..6.75....458.1....7.64..8..67.5...8.8....6...4.1..7...   ED=11.8/1.2/1.2
........1.......2......3..4..2.356...3.72.8..75.6.82...8.5.....3.5.86.7.62..7....   ED=11.8/1.2/1.2
........1.......2......3..4..325.6...57.8.2...6.3.78....6.7.....825.....73.6.8.5.   ED=11.8/1.2/1.2
```

Conclusion: as of now, in addition to Loki (and its equivalent 11.8 form), there are two 11.8 puzzles not in T&E(2):
........1.....2.......3..45.16.23...27.8.61..3.871.6...32.68..718..7....6.7...... 29c not in T&E(2)
........1.....2.34.35.......62......7.3.25..885...67...7853....32..68...5.62.7.8. 30c not in T&E(2)

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

Re: The hardest sudokus (new thread)

by **marek stefanik** » Mon Mar 07, 2022 8:48 am

Hi Hendrik and Denis,
Check the example I gave.

With 4r4c1 assumed, 12r5c5 are the only candidates that lead to a contradiction with singles and I think it stays true for S4.
Therefore stage 3 of Hendrik's solver (before including turbot fish in the basic solver) shouldn't be able to eliminate 4r4c1.
With the full T&E procedure you just assign 3r5c5 and go on from there, for example with the 3s in r1, reaching a contradiction.

If instead stage 3 picked a candidate, assigned it and gave the result to stage 2, which would then try to reach a contradiction, then it would be T&E(2).

Marek

marek stefanik
Posts: 269
Joined: 05 May 2021

Re: The hardest sudokus (new thread)

by **hendrik_monard** » Mon Mar 07, 2022 11:12 am

> **denis_berthier wrote:**
> .
>
> **Conclusion: as of now, in addition to Loki (and its equivalent 11.8 form), there are two 11.8 puzzles not in T&E(2):**
> **........1.....2.......3..45.16.23...27.8.61..3.871.6...32.68..718..7....6.7...... 29c not in T&E(2)**
> **........1.....2.34.35.......62......7.3.25..885...67...7853....32..68...5.62.7.8. 30c not in T&E(2)**

These two are not minimal. As I understood it, they are an expansion of the group of puzzles on the following lines.
The first relates to Loki and friend(s), and the second to two other puzzles from mith with respectively 26c and 27c.
It is interesting to observe that in the last case the puzzles are in T&E(2) but the expansion is not. I interpret this as an indication that a higher number of clues can cause a higher ranking, even if the 'puzzle' is not minimal. Of course one has to be careful with results obtained for non minimals.

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

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