The hardest sudokus (new thread)

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Re: The hardest sudokus (new thread)

QUOTE

by **eleven** » Tue Mar 15, 2022 10:41 pm

> **denis_berthier wrote:**
> Are you sure it satisfies the parity conditions??

There is a single rectangle 349 in r6c34.

Re: The hardest sudokus (new thread)

QUOTE

by **eleven** » Tue Mar 15, 2022 11:08 pm

> **denis_berthier wrote:**
> CODE: SELECT ALL
> ```
> .......1.....2.34....562....56..1...627.18..8...257..7.....52..6..96.1..8...  EDt=11.8/1.2/1.2 not in TdE(2) No Tridagon
> ```

Here the link between the 2 extremals 1r8c4-7r9c5 can be used to reduce the ER to 10.1 (still a long puzzle).

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Same with new:

```
CODE: SELECT ALL
.......1.....2.34...562....567.1..628.17..7...258..87.....52..6..76.1....  EDt=11.8/1.2/1.2 not in TdE(2) No Tridagon
```

In the next, 5r7c5 implies 3r9c6, which makes it easy.

```
CODE: SELECT ALL
.......1.....2.34195...6.....76.6..8.23...7.35.6....26..78..3.8...7.657.....
```

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[Edit] So it seems to be worth to have the link between 2 extremals in mind.

Last edited by eleven on Tue Mar 15, 2022 2:10 pm, edited 3 times in total.

Re: The hardest sudokus (new thread)

QUOTE

by **hewick_mynard** » Tue Mar 15, 2022 2:08 pm

> Hi Hendrik,
> did you check if some have the same minlex expanded version?

I have no script dedicated to such operation. However I tested manually numbers 3 and 4. As I still can't calculate minlex, I systematically convert all newcomers to minlex:
nr 3: 9876.....956.....4..7fb.3.2.2.8....382.678.3.6...87.92..4.8...6.32 ED=11.8/1.2/1.2
nr 4: 9876.....956.....4..7fb.3.2.2.8....382.678.3.....87.92..4.8...6.32 ED=11.8/1.2/1.2
Expansion leads to the same result for both:
eg: 9876.....956.....4..7fb.3.2.2.8....382.678.3.6...87.92..4.8...6.32.

Re: The hardest sudokus (new thread)

QUOTE

by **marek stefanik** » Tue Mar 15, 2022 4:13 pm

Impressive findings, mith!

Thanks Denis for identifying the puzzles without direct eliminations.
They really show that using the derived links from the TH, the puzzles can often be solved using very simple patterns.

```
CODE: SELECT ALL
.1..2.34..562..56.1.627.18.8..257..7.....52.86.7.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon
```

Rather than eliminating one of the internals as eleven did, let's consider the extremals:

```
CODE: SELECT ALL
.1..2.34..562..56.1.627.18.8..257..7.....52.86.1.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon

.-----------------------------------------------------------------------.
| 2    34589  34579  3489   3479   389    567789 1      |   resolution state after basics
| 18   589    6789   189    179    2      589    3      |   # TH 34589678. internals 1r8c4. 7r9c5
| 1348 3489   3479   13489  5      6      2      789    789
|-----------------------------------------------------------------------|
| 1    4589   7      6      8      4589   1      249    249
| 4589 6      3      7      2      1      589    489    489
| 7    1      249    4589   9      3      6      48     48
|-----------------------------------------------------------------------|
| 4589 7      4589   2      1348   4589   1348   12568  4568-9
| 3    2      4589   14589  6      8      589    19     7
| 6    4589   1      25     4589   7      3458   2569   2569
'-----------------------------------------------------------------------'
```

Triple (7r1c8*7 => 34r7c789) bite (33 or lower)
Max. size overall: 44 EDIT: 14 (1r45r6678. 33B, 8B?: without the last two you could fit another 349 in b78 not in r7 and thus have one in r7c789)

The rest of them can be solved with a short grouped AIC from the internals:

```
CODE: SELECT ALL
.1..2.34..562..56.1.627.18.8..257..7.....52.86.1.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon

.-----------------------------------------------------------------------.
| 2    34589  34579  3489   3479   389    567789 1      |   resolution state after basics
| 18   589    6789   189    179    2      589    3      |   # TH 34589678. internals 1r8c4. 7r9c5
| 1348 3489   3479   13489  5      6      2      789    789
|-----------------------------------------------------------------------|
| 1    4589   7      6      8      4589   1      249    249
| 4589 6      3      7      2      1      589    489    489
| 7    1      249    4589   9      3      6      48     48
|-----------------------------------------------------------------------|
| 4589 7      4589   2      1348   4589   1348   12568  4568-9
| 3    2      4589   14589  6      8      589    19     7
| 6    4589   1      25     4589   7      3458   2569   2569
'-----------------------------------------------------------------------'
```

1r8c4 => 7r9c5 -> 7r9c8 => 1r8c8, still 6 B (BC4 or lower)
Max. size overall: 15 (7r6 cells + 7b9)

I believe that it's worth using the TH links, even if it may seem like they would lead to overcomplicated solutions, as that is rarely the case.

Marek

Last edited by marek stefanik on Tue Mar 15, 2022 7:57 pm, edited 1 time in total.

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Tue Mar 15, 2022 4:16 pm

Sorry, I had written an explanation and somehow it got deleted. The most recent batch is all minimals during the period my internet was down. The 11 9s are the two minimals of the same 29c expanded form, as referenced here: the-hardest-sudokus-new-thread-t6189-1125.html#p103511

I'll be updating the list of expanded forms sometime this week, I just haven't fully automated that process yet.

Re: The hardest sudokus (new thread)

QUOTE

by **eleven** » Tue Mar 15, 2022 5:44 pm

Ah, nice improvements of my quick tries, Marek !

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Tue Mar 15, 2022 6:11 pm

> **denis_berthier wrote:**
> Wow, 2 new 11.8s and a whole lot (38) of new 11.8s, many of which are not in TdE(2).
>
> Are they all independent, i.e. did you stick to your decision to publish only the minlex form of expanded puzzles?

Here are the expanded forms of these puzzles. I've also noted where smaller clue-count expanded forms are "sub-puzzles" of larger counts (e.g. the 11.9s expand to 29c, a couple of the 11.8s expand to 30c which is the 29c plus one more given):

```
CODE: SELECT ALL
.......1.....3.49.16.25..27.61.5..3.87.61..32.87.4t7.3..48.....  (sub-puzzle of a)
.....1.....2.34..562....562..56..1..627.18..8..257...7.....52..6..96.1..8...  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.....1..45..6.....7t.8..32.87.8.6.28...837.1..7.28.6.  ED=11.8/1.2/1.2 not in TdE(2)

.....1.....2.34.39.....42....7.3.25.389..57.6753..3.42.8..32.47.1..16.
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25.2.78.35.267.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25..7t.83.267.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25..7t.83.267.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34.23..5...6.7t.5..423...7.6.5..47...25.2.78.83..47.  ED=11.8/1.2/1.2 not in TdE(2)

.....1.....2.34.23..5..5423...2.t.6.6.38.7.5...7t...5.2.86.83..78.5  (sub-puzzle of b)
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25.2.78.83..47.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25..7t.83.267.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34.23..5...6.7t..5423....7.6.5..47...25..7t.83..47.5  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34..562..5..26..78..3.8..7..257...7.....52..86.7.8..  ED=11.8/1.2/1.2 not in TdE(2)

.....1.....2.5423..6..26..78..3.8..7..257...7.....52.78.6.68.27..7.35.6..  (sub-puzzle of b)
.....1.....2.34..562..56..1..627.18..8..257...7.....52..86.7.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon
.....1.....2.34195..6.....76.6..8.23...7.35.6....26..78..3.8...7.657.....  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon
.....1.....2.34195...76.6..8.23...7.35.6....26..78..3.8...7.657.....  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon
.....1.....2.34..562..5..26..78..3.8..7..257...7.....52.86.7.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon

.....123..1.245.6.3..6..6.52..7.8.6...1..456.3.3.24.15..4.1.3.62  (sub-puzzle of b)
.....1.....2.34..562..56..1..627.18..8..257...7.....52..86.7.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon

.....1.....2.34.15..1..5423...2.t.6.6.38.7.5...7t...5.2.86.83..278.5.15.
.....1.....2.34..562..5..26..78..3.8..7..257...7.....52..86.7.8..  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34..2.15.6...562...2.1.6.3.6.5..4..7.6.8.53..7.8.6...  ED=11.8/1.2/1.2 not in TdE(2)

.....1.....2.34.35..6...72....65..78..6.3.257.6.5653...3.72.6..52.78.6.  (sub-puzzle of a)
.....1.....2.34..562...1.25..267.38..78.6.3...6.....5.2.86.791..7..  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.39..562.....1..6..2..35..87.8.7.25...896.5.6.38.17..  ED=11.8/1.2/1.2 not in TdE(2)

.....1.....2.34..562..5..26..78..3.8..7..257...7.....52.78.6.68.27..7.35.6..  (sub-puzzle of b)
.....1.....2.34..562..56..1..627.18..8..257...7.....52..86.7.8..  ED=11.8/1.2/1.2 not in TdE(2) No Tridagon

.....1.....2.5423..6....26..78..3.8..7..257...7.....52.78.6.68.27..7.35.6..  (sub-puzzle of b)
.....1.....2.34..562...1.257..267.38..78.6.3...6.....5.2.86.791..7..  ED=11.8/1.2/1.2 not in TdE(2)
.....1.....2.34195..6.....76.6..8.53...3.72.6...72.....65..78..8.3.257.6  ED=11.8/1.2/1.2 not in TdE(2)
```

Note that all but one of the puzzles you've marked as "no tridagon" (that is, having more than one extra candidate as guardians for the pattern having more than one guardian cell with extra candidate(s)) are related to each other. The outlier appears to be the first case of a puzzle with more than one guardian which can be expanded to a puzzle with only one guardian while remaining not in TdE(2).

I will work on automating this process so we can better see how these puzzles are related.

Last edited by mith on Wed Mar 16, 2022 5:46 pm, edited 1 time in total.

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Tue Mar 16, 2022 8:19 pm

I hadn't checked this in a while, but there is a new lower bound for CYFC+DFC:

```
CODE: SELECT ALL
.....1.....23.4..5..6..3.2..7.4...1.2..8.5...9..4.8.47...3.9...5..5  ED=11.2/1.2/1.2  DLFC+DFC
```

Huge amount of overlap now between +WFC (10.6-11.7) and +DFC (11.2-11.9).

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Tue Mar 16, 2022 9:56 pm

I checked Loki and its 27c friend (rating 11.8 in gsf minlex form, but the same expanded form as Loki) with 3s0Fs fork of SE, to see what the node counts are (for all 11.8+ steps):

Loki:

```
CODE: SELECT ALL
t=  0.  .....0.5.......168..4....28.9.2.6416...2...6.9.82.4..41.6..
11.0. Contradiction Forcing Chain (w/363 nodes): R3C1 b9 == >>> R4C2 l bothb on a off: r3c1n4
11.0. Contradiction Forcing Chain (w/363 nodes): R3C1 b9 == >>> R4C2 l bothb on a off: r3c1n9
11.0. Contradiction Forcing Chain (w/363 nodes): R2C5 b2 == >>> R4C2 l bothb on a off: r2c5n2
11.0. Contradiction Forcing Chain (w/363 nodes): R2C5 b2 == >>> R6C5 l bothb on a off: r2c5n2
t=  0. Region Forcing Chains (w/363 nodes): 5 in column >>> R3C3 b9 off: r3c5n4
```

27c 11.8:

```
t=  0.  .....0.3.45.1.23...267.81..73.61.8..17.6..8....1.3.97.6
11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R5C8 b.bothb on a off: r1c8n3
11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R6C8 b.bothb on a off: r1c8n3
11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R8C8 b.bothb on a off: r1c1n3
```

At some point I'd like to dig into the pruning mechanism and figure out why exactly that 11.8 is pruned in Loki but not in the 27c/other morphs.

And the newer 27c 11.9 (like is the same):

```
CODE: SELECT ALL
t=  0.  .....0.3.45.1.23...267.8..73.61.8..17.6..8....1.3.96.78.1..7.
11.0. Contradiction Forcing Chain (w/293 nodes): R3C2 l == >>> R6C4 b.bothb on a off: r1c8n7
12.0. Contradiction Forcing Chain (w/293 nodes): R3C2 l == >>> R8C4 b.bothb on a off: r1c2n7
```

Re: The hardest sudokus (new thread)

QUOTE

by **denis_berthier** » Wed Mar 16, 2022 7:30 am

> **mith wrote:**
> Note that all but one of the puzzles you've marked as "no tridagon" (that is, having more than one extra candidate as guardians for the pattern)
>
> More precisely: having extra candidates in more than one cell (the target cell). The number of extra candidates in the target cell is irrelevant.
>
> I'm aware (see also eleven's and Marek's posts) that there is a more general situation where no candidate can be eliminated but a "strong link" can instead be found. This is IMO a different rule. What I've studied is the "tridagon elimination rule", not such generalizations that have a very different kind of conclusion. That's what I meant by "no tridagon".

Re: The hardest sudokus (new thread)

QUOTE

by **denis_berthier** » Wed Mar 16, 2022 7:52 am

> **mith wrote:**
> I checked Loki and its 27c friend (rating 11.8 in gsf minlex form, but the same expanded form as Loki) with 3s0Fs fork of SE, to see what the node counts are (for all 11.8+ steps):
> Loki:
>
> ```
> CODE: SELECT ALL
> t=  0.  .....0.5.......168..4....28.9.2.6416...2...6.9.82.4..41.6..
> 11.0. Contradiction Forcing Chain (w/363 nodes): R3C1 b9 == >>> R4C2 l bothb on a off: r3c1n4
> 11.0. Contradiction Forcing Chain (w/363 nodes): R3C1 b9 == >>> R4C2 l bothb on a off: r3c1n9
> 11.0. Contradiction Forcing Chain (w/363 nodes): R2C5 b2 == >>> R4C2 l bothb on a off: r2c5n2
> 11.0. Contradiction Forcing Chain (w/363 nodes): R2C5 b2 == >>> R6C5 l bothb on a off: r2c5n2
> t=  0. Region Forcing Chains (w/363 nodes): 5 in column >>> R3C3 b9 off: r3c5n4
> ```
>
> 27c 11.8:
>
> ```
> t=  0.  .....0.3.45.1.23...267.81..73.61.8..17.6..8....1.3.97.6
> 11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R5C8 b.bothb on a off: r1c8n3
> 11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R6C8 b.bothb on a off: r1c8n3
> 11.0. Contradiction Forcing Chain (w/302 nodes): R2C3 b1 == >>> R8C8 b.bothb on a off: r1c1n3
> ```
>
> At some point I'd like to dig into the pruning mechanism and figure out why exactly that 11.8 is pruned in Loki but not in the 27c/other morphs.
>
> I don't know what "pruning mechanisms" you're talking about and they may add there own parts to the problem.
> But, generally speaking, depending on the order of eliminations, an elimination that required n inference steps (nodes) in one path may require fewer ones if one of the nodes has been deleted by previous steps.
> This is the general problem of the underlying RNs for any definition of complexity based on the number of inferences (nodes).
>
> In SE, if a puzzle is rated high, but the number of nodes in the hardest step is just above one of the arbitrary thresholds, it's more likely that a morph (which will use a different path) will be rated lower.

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Wed Mar 16, 2022 9:13 pm

The pruning issue was discussed earlier in the thread as one of the reasons "why" SE doesn't have confluence. The search for chains isn't exhaustive, it is pruning the search tree at some (unknown to me) point.

Obviously the order of elimination matters in the complexity of subsequent steps, but this should only ever reduce the complexity (barring uniqueness considerations, which is a separate issue not relevant here). What appears to be happening here is that there is some difference in order of eliminations (occurring before the 11.8 steps even - I need to take a closer look to determine exactly where the differences and which is resulting in choosing a different pair of 11.8 steps (despite the node counts being the same, we can see immediately that they are different - in Loki, same digit in two cells, giving an immediate single; in the 11.8 morph, two digits in same cell, resulting in a naked single step and an 11.1 chain before getting the single).

The point is that the two 11.8 steps in the latter case must still exist in Loki after the latter case itself is found, but they are now rated 11.9. Even if there were some eliminations reducing the node count in the 11.8 puzzle that are missing from Loki (that doesn't appear to be happening from my analysis in the thread) the GUI - the 11.8 steps are available before the single; the steps leading to those eliminations should also be present in Loki, again at a lower complexity. Instead, what we are seeing is that something - presumably the pruning, but I don't know that for sure yet - is causing Loki to miss those lower complexity chains completely.

Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Wed Mar 16, 2022 4:41 pm

Only 11.6-11.7 for today's update (the last 11.6 is a 23c pearl though):

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Re: The hardest sudokus (new thread)

QUOTE

by **mith** » Wed Mar 16, 2022 4:56 pm

For further clarity on the SE rating difference, I reverted Loki to gsf minlex (still 11.9), added singles to both puzzles without morphing, and compared the solve paths.

Mapping between puzzles: digits 6<->8; rows 4<->8, 5<->7, 6<->9; columns 2<->3

```
CODE: SELECT ALL
.....1.....3..456.6.....71.8....23..47.8.827.61..23..7.381.6.  ED=11.5/11.8/1.4
t=  0.4. Hidden Pair: Cells R4C4,R5C4: 2,3 in block: r4c4n2,4,5,9, r5c4n4,5,9
10.0. Contradiction Forcing Chain (w/10 nodes): R4C4 b5 == >>> R1C4 b.bothb on a off: r4c6n9
10.1. Region Forcing Chains (w/40 nodes): 1 in row >>> R6C6 b off: r6c8n9
9.0. Contradiction Forcing Chain (w/20 nodes): R4C5 b5 == >>> R1C6 b.both on a off: r4c6n5
10.0. Contradiction Forcing Chain (w/40 nodes): R2C4 b1 == >>> R6C4 b.both on a off: r2c4n4
10.0. Contradiction Forcing Chain (w/76 nodes): R2C4 b1 == >>> R6C6 b.both on a off: r2c4n4
10.0. Contradiction Forcing Chain (w/140 nodes): R4C4 b4 == >>> R6C4 b.both on a off: r4c6n4
10.0. Contradiction Forcing Chain (w/140 nodes): R4C4 b4 == >>> R6C6 b.both on a off: r4c6n4
11.1. Contradiction Forcing Chain (w/140 nodes): R2C3 b1 == >>> R6C6 b.both on a off: r2c6n5
11.1. Contradiction Forcing Chain (w/140 nodes): R2C3 b1 == >>> R8C6 b.both on a off: r2c6n5
11.1. Contradiction Forcing Chain (w/140 nodes): R5C4 b2 == >>> R6C4 b.both on a off: r5c6n4
2.0. Pointing: Cells R4C7,R6C7,+R6C7 = in block and column: r6c7n4
10.0. Contradiction Forcing Chain (w/140 nodes): R4C4 b4 == >>> R6C4 b.both on a off: r2c6n9
10.0. Contradiction Forcing Chain (w/140 nodes): R4C4 b4 == >>> R6C6 b.both on a off: r2c6n9
10.1. Contradiction Forcing Chain (w/118 nodes): R2C4 b1 == >>> R6C6 b.both on a off: r1c2n9
10.1. Contradiction Forcing Chain (w/118 nodes): R2C4 b1 == >>> R8C6 b.both on a off: r1c2n9
10.1. Contradiction Forcing Chain (w/118 nodes): R2C1 b1 == >>> R6C6 b.both on a off: r1c2n9
1.2. Hidden Single: R1C1. 1 in block 1: r1c1n1
10.1. Contradiction Forcing Chain (w/118 nodes): R2C3 b1 == >>> R6C6 b.both on a off: r1c2n9
12.0. Contradiction Forcing Chain (w/440 nodes): R2C3 b1 == >>> R6C2 b.both on a off: r1c2n9

.....1.....3..456.6.....707.81..73.61.8..17.6..68.....2.3.87.6 ED=11.5/11.8/1.4
t=  0.4. Hidden Pair: Cells R7C6,R8C6: 2,3 in block: r7c4n4,5,8, r8c4n1,4,5,9
10.0. Contradiction Forcing Chain (w/10 nodes): R7C6 b6 == >>> R1C6 b.bothb on a off: r8c6n9
10.1. Region Forcing Chains (w/40 nodes): 1 in row >>> R6C6 b off: r8c6n9
9.0. Contradiction Forcing Chain (w/20 nodes): R8C5 b5 == >>> R1C6 b.both on a off: r8c6n5
10.0. Contradiction Forcing Chain (w/40 nodes): R2C4 b1 == >>> R6C4 b.both on a off: r2c4n4
10.0. Contradiction Forcing Chain (w/76 nodes): R2C4 b1 == >>> R6C6 b.both on a off: r2c4n4
10.0. Contradiction Forcing Chain (w/140 nodes): R8C4 b4 == >>> R7C4 b.both on a off: r3c4n4
10.0. Contradiction Forcing Chain (w/140 nodes): R8C4 b4 == >>> R7C6 b.both on a off: r3c4n4
10.0. Contradiction Forcing Chain (w/143 nodes): R2C3 b1 == >>> R6C4 b.both on a off: r2c6n4
10.0. Contradiction Forcing Chain (w/143 nodes): R2C3 b1 == >>> R6C6 b.both on a off: r2c6n4
10.1. Contradiction Forcing Chain (w/118 nodes): R2C4 b1 == >>> R6C6 b.both on a off: r1c2n9
10.1. Contradiction Forcing Chain (w/118 nodes): R2C4 b1 == >>> R8C6 b.both on a off: r1c2n9
10.1. Contradiction Forcing Chain (w/118 nodes): R2C1 b1 == >>> R6C6 b.both on a off: r1c2n9
1.2. Hidden Single: R1C1. 1 in block 1: r1c1n1
10.1. Contradiction Forcing Chain (w/118 nodes): R2C3 b1 == >>> R6C6 b.both on a off: r1c2n9
12.0. Contradiction Forcing Chain (w/440 nodes): R2C3 b1 == >>> R6C2 b.both on a off: r1c2n9
```

There are some minor differences before the 11.8 steps:

Steps 5-6 give the same eliminations at the same complexity, using a different column for the contradiction.
Step 11 gives the same elimination at different complexity (149 vs. 143 nodes) and with a different contradiction.
Step 13 gives different eliminations at the same complexity, but step 14 provides the other elimination via pointing so the pencilmark grids return to the same state.
Step 15 gives the same elimination at the same complexity, using a different row for the contradiction.
Step 16, the first 11.8 step, is identical.
Finally at Step 19 they diverge. In the 11.5 step, it chooses the same digit as step 18 in a different cell, directly giving the hidden single on that digit. In the 11.8, step 19 eliminates a different digit from the same cell, resulting in pointing on the second digit, followed by an 11.1 **eliminating the same candidate as the second 11.8 in the first puzzle.**

So the only relevant differences in these puzzles after the 30th digit is placed is the 2 eliminated from r1c8 and r7c7. However, these differences are not found at 11.8 or less in the first puzzle, as you would expect - so either the less complex version of the -3r1c8 chain is pruned at this point, or something else screwy is going on to actually increase the complexity of that chain despite the extra digit.

Re: The hardest sudokus (new thread)

QUOTE

by **Jocksey** » Wed Mar 16, 2022 6:28 pm

> **mith wrote:**
> For further clarity on the SE rating difference, I reverted Loki to gsf minlex (still 11.9), added singles to both puzzles without morphing, and compared the solve paths.

This is probably related to an SE bug first found in 2010: http://forum.enjoysudoku.com/help-with-sudoku-explainer-t6677.html#p201789

Ikoudkou (partially) fixed this problem: http://forum.enjoysudoku.com/help-with-sudoku-explainer-t6677.15.html#p204072

I recently mentioned the Ikoudkou fix here: http://forum.enjoysudoku.com/suggestions-for-a-minimal-sudokuexplainer-in-56-712-bytes-t36049-15.html#p317486

> **Jocksey wrote:**
> The Ikoudkou fix is only applied to the nested parts of chains in dynamic and multiple chains.
> A version of Ikoudkou fix must also be applied to the final chain when determining the chain to be selectedsupplied.

I have a version of SE with an improved Ikoudkou fix, but this also has one issue, and I've not investigated further.

Yet to the best 2-5x of gsf minlex'ed puzzles, the 'improved' Ikoudkou fix rates both as ED=11.8/11.8/3.4 with similarities in the solving path:

```
CODE: SELECT ALL
.....1.....3..456.6.....71.8....23..47.8.827.61..23..7.381.6.  ED=11.5/11.8/1.4
```

Solution Path: Show

```
CODE: SELECT ALL
.....1.....3..456.1.23...267.81..73.61.8..17.6...68.....2.3.87.6 ED=11.8/11.8/3.4
```

Solution Path: Show

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