The hardest sudokus (new thread)

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Re: The hardest sudokus (new thread)

Quote

by **champagne** » Wed Aug 08, 2018 12:04 am

champagne
2017 Supporter
Posts: 2202
Joined: 24 August 2007
Location: French Brittany

Old Mutter wrote:
Yes, I did understand that. But you said that the error only affected I2_notes.txt. But now there are sudokus missing from I1_files.txt that would still belong there, because they aren't redundant.

Example:
I copied these from the pm_1812-01_files.txt.

Hi Otto, Jellian,
Late answer, but you are right, these ones are not redundant and have been erased (and disappeared in all files).
As I used the 'sdtp' process to minimalize them, the internal number has been modified.
I surely made a wrong action in the cleaning process.

Thanks

Re: The hardest sudokus (new thread)

Quote

by **MN_Springs** » Thu Aug 09, 2018 10:06 am

MN_Springs
Posts: 1374
Joined: 25 January 2007
Location: In the middle. Rushing down springs, one by one.

this might be of interest to tarek and the other pencilmark-only sudoku enthusiasts

i was messing around with sudoku explainer's ELA and tried to make champagne's 11.W11.W11.8 hardest ever puzzle even harder by adding pencilmarks to known clues. in this puzzle the only clue that lets you add a candidate to it without invalidating the puzzle is b7c4, which can be replaced with 26).

modifying the grid in the GUI by changing b7c4 to b6, and stepping through the puzzle, you find that the few tests are -b7c2 (11.8) and -4r6c8 (11.9)

and then this happens

new SE rating record!

i don't know what the overall rating of the puzzle will be but probably 12.0, there are already 12 tests with that rating in this spot if you click on get next hint

unfortunately you can't use tarek's ultra hard pencilmark sudokus in se using this method since the interface doesn't process beyond dynamic chains if a puzzle has 17 minimum clues check, and also if you remove too many candidates by hand, it throws up some illegal argument exception error that i found a while ago when messing with the gui, so this won't work, but it's nice though

p.s. yeah i know what you're thinking from the pic, this is an old laptop, so don't judge me for having mirBC pinned to the taskbar! i haven't used it in years i promise

Re: The hardest sudokus (new thread)

Quote

by **tarek** » Thu Aug 09, 2018 11:41 pm

tarek
Posts: 1231
Joined: 05 January 2006

MN_Springs wrote:
this might be of interest to tarek and the other pencilmark-only sudoku enthusiasts

i was messing around with sudoku explainer's ELA and tried to make champagne's 11.W11.W11.8 hardest ever puzzle even harder by adding pencilmarks to known clues. in this puzzle the only clue that lets you add a candidate to it without invalidating the puzzle is b7c4, which can be replaced with 26).

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It is good that you are thinking in this way. The hardest Sudokus haven't been tapped into properly and having new ideas of how to find/create them is great. At the moment only a handful are discussing sudokus with ways to rate the difficult puzzles using SE. I'm sure we will have another thread for the hardest Sukakus very soon

tarek

Re: The hardest sudokus (new thread)

Quote

by **dobrichev** » Fri Aug 09, 2018 5:40 am

dobrichev
Posts: 1007
Joined: 18 May 2007

MN_Springs wrote:
new SE rating record!

Surely it is.
You have the chance this puzzle has "backdoor of size 0 in Dynamic Region Forcing Chains". For even harder puzzles, SE gives up after thinking for 2-3 days.

Re: The hardest sudokus (new thread)

Quote

by **coldcow** » Fri Aug 10, 2018 9:40 pm

coldcow
Posts: 1227
Joined: 05 May 2005
Location: Illinois

Now I understand pencil mark sudoku ... and I thought sudoku was a topic !!!
I found the puzzle ... and its been given a 12.0 ... BOOM ..... well found !

```
CODE: SELECT ALL
.-------.-------.-------.
| 9     8       1(34)   | 7       5(46)   1(34)   | 1(34)   1(45)   (23)    |
| 7       1(23    1(234   | 1(234   9(69    1(346   | 8       1(4569  2(689   |
| 1(23    1(23    6       | 9       8       5       | 7       3       4       |
:-------+-------+-------:
| 1(68    4       7       | 1(68    6(78    9       | 5       2       3       |
| 1(258   1(26    3       | 5       1(68    1(68    | 9       4(68    7       |
| 1(68    9(68    2       | 3       4       7       | 6       4(678   1(5     |
:-------+-------+-------:
| 1(5(68  1(5(7   8       | 1(5     1(67    6       | 1       1(67    9(67    |
| 3       1(5     1(5     | 1(5     2       1(8     | 4       1(67    1(67    |
| 1(68    1(67    1(69    | 4(68    4(78    3       | 1(8     7       5(6     |
'-------'-------'-------'
                                                        Champagne Dry 12+11.9/11.9/11.8

.-------.-------.-------.
| 9       8       1       | 7       5       1       | 1       1       (2      |
| 7       1       (23     | 1(234   9       1(3     | 8       1(4     2       |
| 1       (23     6       | 9       8       5       | 7       3       4       |
:-------+-------+-------:
| 1       4       7       | 1       6       9       | 5       2       3       |
| 1       2       3       | 5       1       8       | 9       4       7       |
| 1       9       2       | 3       4       7       | 6       4       1       |
:-------+-------+-------:
| 1       1       8       | 1       1       6       | 1       1       9       |
| 3       1       1       | 1       2       1       | 4       1       1       |
| 1       1       4       | 4       7       3       | 1       7       5       |
'-------'-------'-------'
                                                        Sp/Lu removed

The 2 and 4 give multiple solutions - so we remove them and we are left with the sudoku puzzle
The 9
This is a sudoku puzzle ... quite difficult to show that this is so ...
The 9 defines the puzzle

.-------.-------.-------.
| 9       8       1       | 7       5       1       | 1       1       (2      |
| 7       1       (23     | 1(234   9       1(3     | 8       1(4     2       |
| 1       (23     6       | 9       8       5       | 7       3       4       |
:-------+-------+-------:
| 1       4       7       | 1       6       9       | 5       2       3       |
| 1       2       3       | 5       1       8       | 9       4       7       |
| 1       9       2       | 3       4       7       | 6       4       1       |
:-------+-------+-------:
| 1       1       8       | 1       1       6       | 1       1       9       |
| 3       1       1       | 1       2       1       | 4       1       1       |
| 1       1       4       | 4       7       3       | 1       7       5       |
'-------'-------'-------'
```

no such pm clues in 11.4m_b_metcalf ... ? but bound to be in others ....

Re: The hardest sudokus (new thread)

Quote

by **tarek** » Sat Aug 11, 2018 4:44 am

tarek
Posts: 1231
Joined: 05 January 2006

As I told Madam on a different thread: With Sudoku, the concept of Minimal puzzle can get a bit confusing as we are adding candidates to the puzzle to achieve that. A minimal Sudoku is a valid single solution puzzle where **addinn** any candidate to the pencilmark grid would result in multiple solutions!

Translating what happens in a vanilla sudoku to sudoku, Removing a clue from a vanilla sudoku cell means that your actually adding 8 candidates to the pencilmark grid in that cell.

No need to test a Sudoku for difficulty unless it is minimal and therefore the potential of using already known difficult vanilla sudokus is huge.

All of the hardest vanilla sudokus will be good seeds for SE debasing Sudoku. The Singles backdoor size 3 puzzles (e.g. Easter monster) could be a good starting point.

tarek

Re: The hardest sudokus (new thread)

Quote

by **MN_Springs** » Sat Aug 11, 2018 4:57 am

MN_Springs
Posts: 1374
Joined: 25 January 2007
Location: In the middle. Rushing down springs, one by one.

tarek wrote:
Translating what happens in a vanilla sudoku to sudoku, Removing a clue from a vanilla sudoku cell means that your actually adding 8 candidates to the pencilmark grid in that cell.

No need to test a Sudoku for difficulty unless it is minimal and therefore the potential of using already known difficult vanilla sudokus is huge.

um no actually you're adding way more than 8 candidates because you're also adding the value of the clue that you removed to all the cells that can see the clue.

for instance when i get rid of b7c4 i'm adding extra 9's to all cells in r7, b8 and col that don't already see a 9

you can extend this idea as follows, if a puzzle has multi solutions when you add a candidate to a known cell, you can remove some of those extra pencilmarks created and see if it's valid. this still gives you a proper superset of what you started with. for instance if you take the champagne puzzle with r7c4 replaced with 56 as above, you can then also replace 9r5c7 with 58 but the puzzle will have multi solutions, you can make it unique again by removing candidates 5r5c7 and this still covers all candidates of the puzzle you started with.

you can also play with crossplay with blocksizes rather than linkages, like you can then replace 9r1c1 with 9r1c13 in block 1 (i.e. get rid of all other 9s in block 1) and you still get a unique solution, and then replace 9r3c3 with 6r13c3 similarly

finally i can then replace 5r3c5 with 34r3c5+5r3c5, am on phone right now otherwise i'd show the full modified pm grid

the resulting puzzle after these 5 modifications is rated as 12 to get the first number but i spent a few hours stepping through the puzzle and there are a lot of se 12 steps but no 12.1 is meaningful in reality. i can't remove another clue because then we would yell at me that it's only got 16 clues and won't do any processing beyond dynamic chains

i'll take a closer read of your sukaku related stuff in the interactive games forum but it looks interesting for sure. i'll comment on it in a while

also if so is this pathetically slow at rating puzzles at this level then what we really need is a pencilmark version of sdtr instead. anyone up for it?

Re: The hardest sudokus (new thread)

Quote

by **dobrichev** » Sun Aug 12, 2018 3:02 pm

dobrichev
Posts: 1007
Joined: 18 May 2007

coloco wrote:

```
CODE: SELECT ALL
.-------.-------.-------.
| 9       8       1       | 7       5       1       | 1       1       (2      |
| 7       1       (23     | 1(234   9       1(3     | 8       1(4     2       |
| 1       (23     6       | 9       8       5       | 7       3       4       |
:-------+-------+-------:
| 1       4       7       | 1       6       9       | 5       2       3       |
| 1       2       3       | 5       1       8       | 9       4       7       |
| 1       9       2       | 3       4       7       | 6       4       1       |
:-------+-------+-------:
| 1       1       8       | 1       1       6       | 1       1       9       |
| 3       1       1       | 1       2       1       | 4       1       1       |
| 1       1       4       | 4       7       3       | 1       7       5       |
'-------'-------'-------'
```

coloco's version of 999_Springs's sukaku of champagne's 11.W11.W11.8 is rated by SukakuExplainer as ED=12.0/12.0/11.8.

I think tarek's mailyn5 sukaku here is at least a 12.6, as after a few hours I CH Crol out of SE.

Re: The hardest sudokus (new thread)

Quote

by **tarek** » Sat Aug 12, 2018 9:40 pm

tarek
Posts: 1231
Joined: 05 January 2006

dobrichev wrote:
coloco's version of 999_Springs's sukaku of champagne's 11.W11.W11.8 is rated by SukakuExplainer as ED=12.0/12.0/11.8.

I think tarek's mailyn5 sukaku here is at least a 12.6, as after a few hours I CH Crol out of SE.

Re: The hardest sudokus (new thread)

Quote

by **coloco** » Sun Aug 12, 2018 9:46 pm

coloco
Posts: 1227
Joined: 05 May 2005
Location: Illinois

tarek wrote:
Translating what happens in a vanilla sudoku to sudoku, Removing a clue from a vanilla sudoku cell means that your actually adding 8 candidates to the pencilmark grid in that cell.

No need to test a Sukaku for difficulty unless it is minimal and therefore the potential of using already known difficult vanilla sukakus is huge.

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for instance when i get rid of b7c4 i'm adding extra 9's to all cells in r7, b8 and col that don't already see a 9

This happens because many electronic solvers perform an automatic cleanup of the pencilmark grid when paste in a vanilla sudoku. This cleanup is a form of solving and what you did is correct in that environment. Disable this cleanup or Minimize (or should I say Maximize) the grid before making any alterations as an alternative.

tarek

Re: The hardest sudokus (new thread)

Quote

by **coloco** » Sun Aug 12, 2018 9:49 pm

coloco
Posts: 1227
Joined: 05 May 2005
Location: Illinois

dobrichev wrote:
...SukakuExplainer as ED=12.0/12.0/11.8.

Sukaku Explainer

We better be careful to only abbreviate this to **SE**=12.0/12.0/11.8

Re: The hardest sudokus (new thread)

Quote

by **tarek** » Sun Aug 12, 2018 9:50 pm

tarek
Posts: 1231
Joined: 05 January 2006

coloco wrote:
dobrichev wrote:
...SukakuExplainer as ED=12.0/12.0/11.8.

Sukaku Explainer

We better be careful to only abbreviate this to **SE**=12.0/12.0/11.8

Reminds me of "South Exchange Street"

Hello

Quote

by **Khanna** » Sun Aug 12, 2018 1:42 pm

Khanna
Posts: 1
Joined: 11 August 2010
Location: Guadeloupe

Hello, thanks!

Re: The hardest sudokus (new thread)

Quote

by **denis_berthier** » Sun Aug 12, 2018 9:44 am

denis_berthier
2010 Supporter
Posts: 3538
Joined: 19 June 2007
Location: Paris

MN_Springs wrote:
this might be of interest to tarek and the other pencilmark-only sudoku enthusiasts

i was messing around with sudoku explainer's ELA and tried to make champagne's 11.W11.W11.8 hardest ever puzzle even harder by adding pencilmarks to known clues. in this puzzle the only clue that lets you add a candidate to it without invalidating the puzzle is b7c4, which can be replaced with 26).

The original (Sudoku Explainer) score, W6.7 ... 7.4 ... 6.5 ... 4.5 ... 5.3 ... 79.5 ... 2 ... 1.35, 0 ... 8 ... 2.2 ... 11.W11.W11.W11.RD.GP.champagne dry.0.12;
It is by no means the hardest ever puzzle. (SER is meaningful in computing hardness, but the next two measures are totally irrelevant.) See below for the real 3 hardest.
The modified (Sudoku Explainer) score is W6.7 ... 7.4 ... 6.5 ... 4.5 ... 5.3 ... 79.5 ... 2 ... 1.8(56), 0 ... 1 ... 4 ... 2.2 , with the obvious (-) notation for the candidate given.
AFAIK, the above is the first example of a Sudoku derived from a Sudoku and harder than it in the SE rating. As there's some correlation between SER and its BgB classification - but no systematic correspondence - the natural question for me was: is it also harder in the BgB classification?

It's obvious that in any rational rating/classification system, this modified Sudoku should be at least as hard as the original Sudoku. But there's no reason why it couldn't be harder, more generally, although it is not the case here.

As the original Sudoku is in B6B, is the derived Sudoku also in B6B or do we need to go to B7B or even any higher BgB? Such computations are very time consuming and there has been some suspense for me (the more so that, beyond B7B, there may be memory overflow problems if I had to go there).
- My first computations showed that **it cannot be solved in B6B**. This required 4 phases of T4D(B6) and a total of 970 candidates tried. (Remember that when the resolution state is changed during a T4D phase, a whole new search has to be tried, so that any candidate has to be tried several times. But it's the most for 4 phases. Of course, this may not be meaningful, as the number of phases depends on the order the candidates are tried in.)
- And the next computations showed that **it can indeed be solved in B7B** - a small disappointment: still nothing to see in B9B
Conclusion: **The derived Sukaku is indeed harder than the original Sudoku puzzle in the BgB classification, but not beyond the hardest known B7B Sudokus.**

A more interesting question for me would now be: **can one find a Sudoku not in B7B?**
First remember that we know only 2 Sudokus in B7B (and 2 of them have SER=11.0, not even 11.9)
3 ...6..3..2.7 ..... 5..8.6.9.2 ..8...9.6..5..4..7 ...1.6.2 (eleven; 11.9 11.9 02.0)
2..47.4..9...5..7.6.8..4.1.3..2..6.5..8.1.3..2.6.7 (eleven; 11.9 01.2 01.2)
..3.4..7..5..2...1...9.7..5..8..2..6.4.9..8 ...9 (m_yoshiaki; 11.9 00.11 00.45 4)
They might be a good starting point for finding harder Sukakus (not speaking of the more general Sukakus, not derived from a single change in a Sudoku.)

Do you have such examples?

Re: The hardest sudokus (new thread)

Quote

by **tarek** » Sun Aug 12, 2018 9:50 pm

tarek
Posts: 1231
Joined: 05 January 2006

denis_berthier wrote:
dobrichev wrote:
For even harder puzzles, SE gives up after thinking for 2-3 days.

Do you have such examples?

Hi Denis,
These are at the moment the most challenging Sukakus to rate.
They all share the same solution and they are all "Singles backdoor size 0" originally posted here

```
CODE: SELECT ALL
.-------.-------.-------.
| 26(7)   1(456(78)       1(456(78)       | 2(456(78)       1(456(78)       1(456(78)       | 1(2(456(78)     1(456(78)       1(456(78)       |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 3       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 4       5       6       |
| 9       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 7       8       1(2(3   |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
'-------'-------'-------'
.-------.-------.-------.
| 26(7)   1(456(78)       1(456(78)       | 2(456(78)       1(456(78)       1(456(78)       | 1(2(456(78)     1(456(78)       1(456(78)       |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 3       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 4       5       6       |
| 9       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 7       8       1(2(3   |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
'-------'-------'-------'
.-------.-------.-------.
| 26(7)   1(456(78)       1(456(78)       | 2(456(78)       1(456(78)       1(456(78)       | 1(2(456(78)     1(456(78)       1(456(78)       |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 3       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 4       5       6       |
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:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
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| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 3       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 4       5       6       |
| 9       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 7       8       1(2(3   |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
'-------'-------'-------'
.-------.-------.-------.
| 26(7)   1(456(78)       1(456(78)       | 2(456(78)       1(456(78)       1(456(78)       | 1(2(456(78)     1(456(78)       1(456(78)       |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(7           1(2(7           | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 3       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 4       5       6       |
| 9       1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 7       8       1(2(3   |
:-------+-------+-------:
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
| 1(2(78  1(2(78          1(2(78          | 1(2(789         1(2(789         1(2(789         | 1(2(789         1(2(789         1(2(789         |
'-------'-------'-------'
```

Thanks for the list. That's something I had already mentioned when it was published.
I still have to write an input function for Sudokus. In the (only) example I solved above, I checked by solving the Sudoku with no given in r7c4 and having the other candidates eliminated "manually" before starting.
Is there any "standard" line format for a Sukaku, such as e.g.
CODE: SELECT ALL

```
26(7)1(456(78)1(456(78)2(456(78)1(456(78)1(456(78)1(2(456(78)1(456(78)1(456(78)1(2(789)1(2(789)1(2(789)1(2(789)1(2(789)1(2(789)1(2(789)1(2(789)1(2(789)
```

So the first is your list above.
This seems simpler than having to put pencilmarks almost everywhere, as I did in the case of an easily modified Sudoku.
It also seems simpler than your 729 line format.
CODE: SELECT ALL

```
1.6(7).1.9(67)6(12)6(78).2(6(78)..4.9(61)2.8(67)(12)(67).5(6(67).7..1(56).7..123...8812(56.6(7812.2..8.123.6.891.....1(245.7861(2345678)2(5)67..123
```

Is there any problem with spaces in a line?

Another question about these puzzles: has anyone finally found a solution to compute their SER?