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Author	Message

m_b_metcalf

Joined: 15 May 2006
Posts: 2160
Location: Berlin

Posted: Sun Jul 05, 2009 7:50 am   Post subject:

The second file I produced, old generator with improved elimination, gave this result:

Code:

```
Number:        51492
Average:    24.40608

    20      3
    21    139
    22   1663
    23   8867
    24  17309
    25  15409
    26   6395
    27   1508
    28    187
    29     11
    30      1
```

I have now produced a file similar to this, but which includes a step after the solution grid generation in which all the 9s are removed from the grid before the u
all the puzzles have only 8 clue values. The summary is:

Code:

```
Number:        29075
Average:    24.92956

    20      1
    21     34
    22    486
    23   2883
    24   7232
    25   9421
    26   6150
    27   2285
    28    510
    29     67
    30      5
    31      1
```

The reduced information content is compensated by half a clue more.

Regards,

Mike Metcalf

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eleven

Joined: 10 Feb 2008
Posts: 313

Posted: Sun Jul 05, 2009 8:30 am   Post subject:

m_b_metcalf wrote:

> **eleven wrote:**
>> So i wondered, why your algorithm produced a list with a different clue distribution.
>
> Hmm, so do I.

Coloin has recently posted a table by dukuso including a column with bottom up generation here. When i compare this one to your set, the distribution is nearly

Code:

```
        dukuso        mike
20      0,000254      0.000296
21      0,008268      0.007891
22      0,080869      0,080203
23      0,273518      0,273125
24      0,364111      0,36775
25      0,209158      0,206953
26      0,055375      0,056006
27      0,007284      0,008062
28      0,000505      0,000328
```

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ronk   Posted: Sun Jul 05, 2009 9:23 am   Post subject:

Joined: 02 Nov 2005
Posts: 2383
Location: Southeastern USA

> **denis_berthier wrote:**
>> **ronk wrote:**
>>> **denis_berthier wrote:**
>>>> Notice that, for symmetry reasons, an AHS(5) is considered to be an ALS(4)...
>>>
>>> Would you please give an example for the meaning of *symmetry* in your statement above?
>>
>> I meant r <-> n or c <-> n or b <-> n super-symmetry.

I understood *super-symmetry* back in the time of rc-space, rn-space, and nc-space. "b <-> n" means nothing to me.

> **denis_berthier wrote:**
>> **ronk wrote:**
>>> Would the "(5) --- (4)" relationships be "modulo" the quantity of fills (clues + placements) in the unit (row, column, box)?
>>
>> The "(5) --- (4)" relationships are the standard complementarity relationships.
>> For me an ALS, AHS or A-Fish in a chain is just a LS, HS or SHS (Fish) modulo the restricted commons.

I was referring to "ALS(5) --- AHS(4)" relationship might be "ALS(5) --- AHS(3)", or "ALS(4) --- AHS(3)" etc.

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denis_berthier   Posted: Sun Jul 05, 2009 9:40 am   Post subject:

Joined: 19 Jun 2007
Posts: 642
Location: Paris, France

Ronk,

Nothing's changed, rc, rn, cn and bn spaces are still there.
By r <-> n I mean permuting r and n (same for c <-> n and b <-> n)
E.g. r <-> n super-symmetry changes LS to HS.

For the rest:
There was something imprecise in my post.
I corrected it.
Does this answer your question?

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m_b_metcalf   Posted: Sun Jul 05, 2009 10:44 am   Post subject:

Joined: 15 May 2006
Posts: 2160
Location: Berlin

> **eleven wrote:**
> Coloin has recently posted a table by dukuso including a column with bottom up generation here. When I compare this one to your set, the distributi
> your 64000 set:

Well, if between cycling, concert-going, cooking, eating, drinking and Wimbledon I've got my thoughts straight, this means that any discrepancy is bewteen **duk**
sudogen0_1M. Which would be, with all due respect, not my problem.

Regards,

Mike Metcalf

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eleven   Posted: Sun Jul 05, 2009 1:10 pm   Post subject:

Joined: 10 Feb 2008
Posts: 313

> **m_b_metcalf wrote:**
> Well, if between cycling, concert-going, cooking, eating, drinking and Wimbledon I've got my thoughts straight, this means that any discrepancy is be
> result and that in sudogen0_1M. Which would be, with all due respect, not my problem.

😊 and i also dont care any more.

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Red Ed   Posted: Sun Jul 05, 2009 1:22 pm   Post subject:
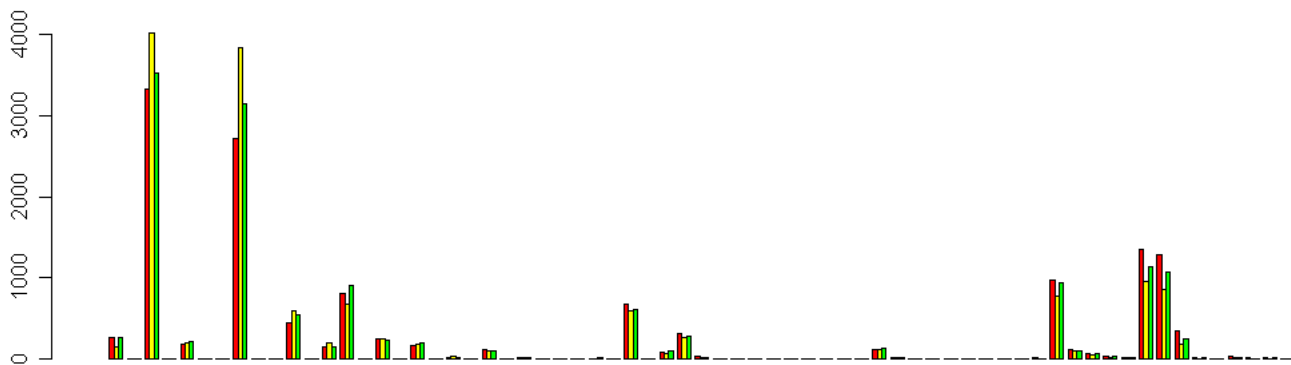
Joined: 06 Jun 2005
Posts: 538

Following Denis' observation that E(SER) varies between generators, even after accounting for number-of-clues, this posting explores SER profiles.

The graph below compares SE ratings for 25-clue minimal puzzles extracted from: sudorules0_1M.txt (red), Mike's algorithm #2 "old generator with improved r
#5 "new generator" (green).

Y-axis = number of puzzles scaled to the size of the smallest collection of puzzles (those for the new generator). You may ignore this axis and just suppose that
the proportion of 25-clue puzzles with a given SE rating.

Oh yes, the SE ratings. They're on the X-axis. Or, they would be, but I couldn't coax the plotter into doing the right thing. They start at 1.3 (small bars), 1.4 (e
increments of 0.1 up to 9.3.

Conclusion: even after accounting for number of clues (which is the most obvious type of generator bias), different minimal puzzle generators can produce subtl differences in their SE rating profiles. The stand-out differences for 25-clue minimals are at SER=1.5 and SER=2.0.

I don't know about you, but I find the variation at SER=1.5 and SER=2.0 quite surprising.

(PS: sorry to disturb you, eleven, you can go back to sleep now! 😃)

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coloin	Posted: Sun Jul 05, 2009 3:07 pm Post subject:
Joined: 05 May 2005 Posts: 1000 Location: Oxford	Mike...... I think what I and **eleven** meant was that the similarity between your results [23.88 etc] was something to celebrate ! 😃 Well done ! C

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StrmCkr	Posted: Sun Jul 05, 2009 3:08 pm Post subject:
Joined: 05 Sep 2006 Posts: 468 Location: Winterpeg	i still have an unanswered question on biasism if all the gerneators are operating of diffrent methods to generate puzzles, would they be infact generating diffrent varatios of grids from the total known numbe dificulty rating that could have very diffren representations. for example the same grid with same number of clues rating may be varations lower or higher. seen very often in the puzzle game threads so why is it a surprise¿

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coloin	Posted: Sun Jul 05, 2009 3:14 pm Post subject:
Joined: 05 May 2005 Posts: 1000 Location: Oxford	Mike.............. see this link ! http://www.sudoku.com/boards/viewtopic.php?t=5871&highlight= 😃 C

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denis_berthier	Posted: Sun Jul 05, 2009 8:55 pm Post subject:
Joined: 19 Jun 2007 Posts: 642 Location: Paris, France	**Red Ed wrote:** The graph below compares SE ratings for 25-clue minimal puzzles extracted from: sudorules0_1M.txt (red), Mike's algorithm #2 "old generator with improved r algorithm #5 "new generator" (green).
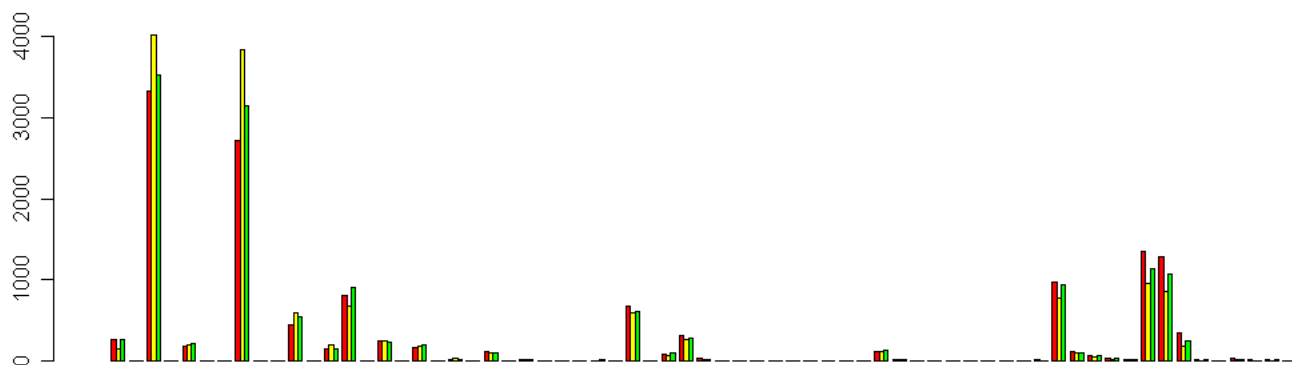
Conclusion: even after accounting for number of clues (which is the most obvious type of generator bias), different minimal puzzle generators can produce sub[...] differences in their SE rating profiles. The stand-out differences for 25-clue minimals are at SER=1.5 and SER=2.0.

With just a naïve global look at the graph, I find it strinking that the 3 distributions are so close (in spite of a few local differences).

Another interesting graph would be a comparison between the sudogen0_1M distributions for 22, 23, 24, 25, 26 and 27 clues, using the NRCZT-rating instead o[...] the SER).

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m_b_metcalf	Posted: Sun Jul 05, 2009 10:47 pm Post subject:

Joined: 15 May 2006
Posts: 2160
Location: Berlin

> **eleven wrote:**
> > 😄 and I also don't care any more.

> **coloin wrote:**
> > I think what I and eleven meant was that the similarity between your results [23.88 etc] was something to celebrate !

Sorry if there's been a misunderstanding. At the end of a long day I was simply expressing my relief that the discrepancy appears to be between two different r[...] solve. Of course I'm happy that I've reproduced **duseko**'s result.

I will now look at generating absolutely minimal puzzles. **coloin** will be glad to know that this requires the application of unavoidable sets in order to avoid unne[...] solutions.

Regards,

Mike Metcalf

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denis_berthier	Posted: Sun Jul 05, 2009 11:05 pm Post subject:

Joined: 19 Jun 2007
Posts: 642
Location: Paris, France

suexg vs Mike's "bottom up" generator

THE SUEXG "TOP DOWN" GENERATOR:
I've always thouht that suexg has two phases:
1) build a *complete* valid grid,
2) delete clues one by one until a (locally) minimal puzzle is reached.

Some cryptic remarks by Eleven and Coloin have thrown some doubt on this (or am I misunderstandig them?).
Can **anyone** (proficient in C) have a look at the suexg C code (more specifically, the version I've been using to generate sudogen0_1M (here: http://www.carva[...] Classif/sudoku_gen.c) and check whether the program really works this way. (A more detailed natural language description of the 2 phases would be welcome t[...]

MIKE'S "BOTTOM UP" GENERATOR, as described by Mike:

> **m_b_metcalf wrote:**
> > 1) To a blank grid add 18 random values at 18 random and distinct locations consistent with the basic constraints.
> > 2) Find the number of solutions.
> > 3) If zero solutions GOTO 1.
> > 4) If one solution GOTO 9 (never happens, but you never know!).
> > 5) If multiple solutions add a new clue and find number of solutions.
> > 6) If zero solutions remove last clue added and GOTO 5.
> > 7) If one solution GO TO 9.
> > 8) If multiple solutions GOTO 5.
> > 9) Visit each clue in turn randomly. If it is redundant remove it.

From these 2 descriptions, it appears that the generation phases of the 2 programs are very different and that they lead to very different eliminations (even if th[...] same): in suexg, additional (redundant) clues that can appear in the complete grid after a unique solution puzzle has been found can remain in the final puzzle, [...] for Mike's program.
It is therefore important to be sure about suexg.

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Allan Barker

Posted: Mon Jul 06, 2009 12:09 am   Post subject:

Joined: 20 Feb 2008
Posts: 280
Location: Bangkok

This is certainly a fascinating discussion and I have been trying to follow along. I thought I would add a few numbers to the fray and if anything is useful, that's

Another Random Puzzle Generator

First, I have yet another generator (YAG) which at least is intended to use only random steps, as described just below the first table. The table compares numbe random count down process, with Dusoku's numbers posted earlier by Coloin. My numbers (column RAB) should compare with Dusoku's first column (column 2 also similar to Mike's numbers for the same process. I didn't count up, but like Mike's idea that this would vary by half a candidate.

Code:

```
         RAB       --------Dusoku-----------
clues            1)      2)       3)      4)
----------------------------------------------
18         0        0       0        0       0
19         1        0     4.3        0       5
20        62       59     182        0     254
21      2391     2428    6051       85    8268
22     33952    33966   61826     1775   80869
23    171445   170727  227480    21648  273518
24    342373   342620  352289   116766  364111
25    298261   298349  248568   286836  209158
26    122462   122691   86061   329853   56006
27     25101    25237   15908   185028    7284
28      2795     2733    1547    50469     505
29       156      205      74     7040      22
30         8      7.6     8.6      486       0
31         0        0       0       12       0
32         0        0       0      2.4       0
----------------------------------------------
aver 24.384    24.38   24.10    25.72   23.88
total 999007
```

Dusoku data:
Col-1] 1M puzzles from 1M different H-class grids [1 puzzle from each grid]

RAB Generator 1M puzzles of 1M grids
Grids
1. Random placement of 81 clues
2. Random Monte-Carlo pairswap convergence to valid solution
Puzzles
3. Random single clue removal to 55 givens.
4. Random single clue removal and test for single solution
5. Random 1 pass removal of extra clues, to local minimum

The closeness of the clue distributions does not necessarily say anything about bias, such as Red Ed's measurements of the various 3322 patterns, and the grou

Intrinsic Properties

Puzzles have intrinsic properties such as the number of clues, the number of candidates, etc, whose "expected" values can vary (and may be additionally biased properties from the 1M puzzles shown above. The 3rd column is the average number of candidates for all puzzles with that number of clues. The columns labele of sets (the original 324 r,c,n,b constraint sets) that have the corresponding number of candidates. Column labeled "2" would be bi-value/local pairs. Note the u downward trend in col 5.

These trends (and others) can affect how particular solvers (methods) solve puzzles and perhaps a puzzle's rated difficulty. This was already shown by Red Ed's SE's rating with Turbot Fish at about SE 6.6. Another example might be Fata Morgana, which lacked available bi-value pairs required to start some methods.

Code:

```
                         cans/truth (set size)
                        -------------------------------
         npuz    cans   1    2     3     4     5     6
------------------------------------------------------------
C 18        0      -    -    -     -     -     -     -
C 19        1      -    -    -     -     -     -     -
C 20       56    265   6.9  19.7  43.8  62.4  58.1  32.5   -
C 21     2391    252   7.1  21.6  47.8  64.6  54.2  29.5   -
C 22    33952    241   7.7  24.1  50.2  64.6  50.7  26.1   -
C 23   171445    231   8.3  26.7  52.2  63.8  47.3  23.1   -
C 24   342373    221   8.9  29.1  53.8  62.6  44.0  20.6   -
C 25   298261    213   9.4  31.5  55.1  60.9  40.9  18.4   -
C 26   122462    205   9.8  33.7  56.1  59.0  37.9  16.6   -
C 27    25101    197  10.2  35.8  56.7  56.9  35.1  15.1   -
C 28     2795    190  10.5  37.4  57.6  54.5  32.4  13.8   -
C 29      156    183  10.7  39.7  57.8  52.3  29.8  12.2   -
C 30        8      -    -    -     -     -     -     -     -
C 31        0      -    -    -     -     -     -     -     -
------------------------------------------------------------
total 999007 average 24.3841
```

Intrinsic Truth

For working with sets, I often look at the number of original truths (the 324 constraint sets) required to solve a grid or a puzzle. This can be considered as an in defined as independent of particular solving methods. The definition though can vary, such as the total number truths to solve a puzzle, the greatest number of

Although not perfect, some "set" solvers can approximate this number because they use an algorithm based only on sets to find this minimum number of truths,

any logic form. Below is table for another 300,000 puzzles that have been rated by one of these solvers. The rightmost column is the average number of truths difficult grid in each puzzle. Singles are rated as zero truths, i.e., not counted.

Code:

```
                      cans/truth (set size)
                    ------------------------------
         npuz   cans   1     2     3     4     5     6    (truth)
-------------------------------------------------------------
C 19      0      -     -     -     -     -     -     -     -
C 20     18    266    5.7  20.8  43.6  60.7  59.6  34.3  (1.06)
C 21    627    252    7.0  21.9  47.8  64.0  54.3  29.5  (1.28)
C 22   9295    241    7.7  24.1  50.0  64.5  50.7  26.2  (1.28)
C 23  46928    231    8.4  26.6  52.1  63.8  47.3  23.2  (1.38)
C 24  92645    221    8.9  29.1  53.8  62.6  44.0  20.6  (1.50)
C 25  81428    213    9.4  31.5  55.0  60.9  40.9  18.4  (1.65)
C 26  33441    205    9.8  33.7  56.1  59.0  38.0  16.5  (1.88)
C 27   6804    197   10.2  35.7  56.7  56.9  35.1  15.1  (2.12)
C 28    775    190   10.2  37.6  57.5  55.0  32.2  13.7  (2.53)
C 29     39    184    8.9  40.3  58.0  52.7  30.0  13.0  (3.00)
C 30      1      -     -     -     -     -     -     -     -
C 31      0      -     -     -     -     -     -     -     -
-------------------------------------------------------------
average = 24.3840 total 272001
```

This trend is similar to what was posted a few pages back, here.
http://www.sudoku.com/boards/viewtopic.php?p=78764#78764

One possible relevance may be to the "Nrczt rating of whips as a guide for rating most any chain and pattern", above, and why that system may work well at ra varying degrees of complexity.

If anyone is interested, I can place the 1M puzzles on my website in a zip file.

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Red Ed

Posted: Mon Jul 06, 2009 1:06 am   Post subject:

Joined: 06 Jun 2005
Posts: 538

> **denis_berthier wrote:**
> I've always thouht that suexg has two phases:
> 1) build a *complete* valid grid,
> 2) delete clues one by one until a (locally) minimal puzzle is reached.

Yes, that's what it does.

I keep seeing "locally" and "absolutely" minimal bandied about. Just to be sure we're talking about the same thing here: I read your "(locally) minimal" to mean of any clue leads to multiple solutions".

For me, "absolutely minimal" means "17 clues". Madmen think it means 16 clues: you must shun these staring-eyed psychopaths!

Last edited by Red Ed on Mon Jul 06, 2009 1:15 am; edited 1 time in total

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