Sudoku Players' Forums

The BUG (Bivalue Universal Grave) principle

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Author	Message
David P Bird Joined: 16 Sep 2008 Posts: 130 Location: Middle England	Posted: Sun Jul 26, 2009 2:42 pm Post subject: quote I think it is a bit of a distortion to call that partitioning of the cells a BUG+5. The deadly pattern cells are all the multi-value ones MINUS r7c56 with three possible disruptors. Now perhaps I've missed something but I can't see any linear inference that can be built on these three candidates. Are we are therefore relying on a Nishio type approach whereby we test the consequences of all three of these candidates being true and look for a common outcome? UGH! Myth's very clever insight recognised that we had identified three different DPs within the grid allowing us to compare the disruptors they require so avoiding any truth states having to be assumed. As it happens that isn't necessary here because we can get linear inferences from the other two DPs, but that won't always be the case. Back to the corollary: If candidate (x) is made true via conjugate links to disruptors (a) and (b) but not to (c), this corollary asserts that (x) can be assigned because it would reduce the unsolved cells to a BUG+1. But I see no logical reason for this. If we set disruptor (c) true we could reduce the position to a BUG+2. At least one of the BUG+1 and BUG+2 scenarios must be true, but how do we know which one?
Back to top	profile pm
eleven Joined: 10 Feb 2008 Posts: 463	Posted: Sun Jul 26, 2009 3:12 pm Post subject: quote Enlightening words. I think my disruptor is destorted and i should have some sleep now.
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Steve K	Posted: Sun Jul 26, 2009 3:46 pm Post subject: quote

Joined: 18 Jan 2007
Posts: 131
Location: Cincinnati Ohio

Prolly of little use, but easily proven.
Given any placement P, (valid or invalid). Given P => Bug+n(P).
SIS[~P,SIS[Bug+n(P)]]

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ronk

Posted: Sun Jul 26, 2009 5:05 pm Post subject: quote

Joined: 02 Nov 2005
Posts: 2489
Location: Southeastern USA

David P Bird wrote:

> I think it is a bit of a distortion to call that partitioning of the cells a BUG+5. The deadly pattern cells are all the multi-value ones MINUS r7c56 with three possible disruptors. Now perhaps I've missed something but I can't see any linear inference that can be built on these three candidates. Are we are therefore relying on a Nishio type approach whereby we test the consequences of all three of these candidates being true and look for a common outcome? UGH!

I chose "BUG+5" because there are five cells on the BUG grid with non-BUG candidates. If you wish to work with **a BUG-Lite** with three cells with non-BUG(-Lite) candidates, fine, but please call it a BUG-Lite+3.

Your comparison to Nishio is unwarranted. The BUG principle uses the concept of a strong inference set which is totally absent with Nishio.

When using the BUG principle, there is no requirement for a "linear inference" ... but it's understandably a preference of people who like to write chains.

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RW

Posted: Sun Jul 26, 2009 9:51 pm Post subject: quote

Joined: 16 Mar 2006
Posts: 981
Location: Finland

ronk wrote:

Code:

```
*-------------------------------------------------*
| 69+5  8    45   | 46   1    59   | 2    3    7  |
| 7     46   2    | 3    48+6 68   | 5    1    9  |
| 59    1    3    | 57   79   2    | 6    8    4  |
|----------------+----------------+----------------|
| 1     2    7    | 45   34   35   | 9    6    8  |
| 48    5    6    | 9    78   1    | 47   2    3  |
| 48    3    9    | 67   2    68+7 | 47   5    1  |
|----------------+----------------+----------------|
| 2     9    1    | 8    6+7  7+6  | 3    4    5  |
| 3     7    8    | 2    5    4    | 1    9    6  |
| 56    46   45   | 1    39   39   | 8    7    2  |
*-------------------------------------------------*
```

1) We have a valid BUG+5, so we know at least one of the non-BUG candidates must be true. However, only one of the non-BUG candidates might ultimately be true ...

Please explain the last sentence. Can I assume the same for my BUG+31?

> **ronk wrote:**
>
> 2) We have r7c5=6 as *any placement of a candidate* which leads to a valid BUG+1 as per Corollary 4. However, based on 1) alone, it is impossible for non-BUG candidate r7c5=7 to have r7c5=6 as an outcome. IOW r7c5=7 implying r7c5<>7 would not be based on the BUG principle.

The first part is true, placing r7c5=6 leads to a BUG+1 and r7c5=6 is a valid move, so this move does not contradict corollary 4 in any way. I have no idea what you are trying to say with the last two sentences...

> **Quote:**
>
> I suppose it's still possible for an exception ... a valid exception ... for non-BUG candidates of bivalued cells, such as r7c5 and r7c6 above, but think it's highly unlikely.

AFAIK grids like the above (that aren't pure BUG grids, all root candidates do not exist exaxtly twice in each unit) are the only grids so far where people have found obvious scenarios to apply corollary 4 (place one digit and 1-2 singles later you have a BUG+1). In fact, in a pure BUG+n grid, any placement that leads to a BUG+(n-k) which is a subset of the original BUG is invalid. (A *subset of the original BUG+n* means that the two root candidates in all unsolved cells remain the same.) Proof:

In a pure BUG+n, all root candidates exists in all units exactly twice. For each placement of digit A, you will eliminate two root candidates A in the same row, column and box. The only way to reduce a BUG+n to a subset BUG+(n-k) is to fill in a pattern were all solved digits remove each candidate from each unit exaclty twice = a deadly pattern => the solved cells form an unavoidable set.

Sorry eleven, I just proved the opposite of your suspision...

RW

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eleven

Posted: Mon Jul 27, 2009 12:16 am Post subject: quote

Joined: 10 Feb 2008
Posts: 463

> **RW wrote:**
>
> Sorry eleven, I just proved the opposite of your suspision...

No problem
Your proof helped me to understand BUG's better now.

A problem is the bad definition of BUG's. So we have pure BUG's and "artificial" BUG's. This already was confusing me yesterday.

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Myth Jellies

Posted: Mon Jul 27, 2009 12:22 am Post subject: quote

Joined: 19 Sep 2005
Posts: 623

> **Quote:**
> Your comparison to Nishio is unwarranted. The BUG principle uses the concept of a strong inference set which is totally absent with Nishio.

Have to agree with ronk on this one. The candidates that allow you to avoid a UR, BUG, or BUG-lite grid are just as pattern based as anything else, and often easier to use once you have found them.

Why do I claim they are easier? Consider that for any non-trivial deduction, one has to find subpatterns (bivalues, bilocations, etc) leading away from some initially detected SIS, and then subpatterns leading to act on some point seen by all endpoints. With a uniqueness SIS that initial breakout has already occurred to some extent and it only remains to bring things back to where they can interact with the same something. Thus, "net" work that would seem far more daunting when starting from scratch, seems much more do-able when starting from a BUG-Lite or UR. Of course full BUGs are much easier thanks also to the primarily binary grid.

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David P Bird

Posted: Mon Jul 27, 2009 1:49 am Post subject: quote

Joined: 16 Sep 2008
Posts: 130
Location: Middle England

This is off topic, but I feel I must respond to some comments.

The terms we use should aid clarity of thought, not obscure it by introducing possible ambiguity. I'm using Deadly Pattern because DP is a better abbreviation in my mind than US for Unavoidable Set, and I don't have to qualify it with "pure" or "full" because the term has been over-stretched, as has happened to BUG. If I had my way, I would also kill off the misnomer Unique Rectangle and call that a DP too!

As I understand it, Nishio examines all the possible locations of a digit in a house (a SIS) and looks for common exclusions that would be created, so anything that resembles that, such as taking all the possible disrupting digits for a DP and looking for a common outcome, is Nishio-like to me. A tell-tale symptom of such deductions is whether they would be classed as guessing if they were notated in reverse.

I have strong opinions about how much branching is acceptable in reaching a deduction, but they are personal, in the minority, and out of place in this thread. Your fine words Myth, using the ease of recognition argument, haven't changed them because that would set a precedent which opens the door far too wide for me.

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RW

Posted: Mon Jul 27, 2009 2:21 am Post subject: quote

Joined: 16 Mar 2006
Posts: 981
Location: Finland

David P Bird wrote:

> The terms we use should aid clarity of thought, not obscure it by introducing possible ambiguity. I'm using Deadly Pattern because DP is a better abbreviation in my mind than US for Unavoidable Set

A Deadly pattern is **not** the same as an unavoidable set. A deadly pattern is a set of **unsolved** cells that has multiple solutions. An unavoidable set is a set of **solved** cells that can be rearranged without affecting the rest of the puzzle. Basically, an unavoidable set is a solution to a deadly pattern. Or the other way around, if you remove all digits in an unavoidable set, you get a deadly pattern.

Code:

```
 | ab ab . |         | A B . |
 +---------+         +-------+
 | ab ab . |         | B A . |

Deadly Pattern    Unavoidable set
```

RW

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ronk

Posted: Mon Jul 27, 2009 2:49 am Post subject: quote

Joined: 02 Nov 2005
Posts: 2489
Location: Southeastern USA

RW wrote:

> **ronk wrote:**
>
> > 2) We have r7c5=6 as *any placement of a candidate* which leads to a valid BUG+1 as per Corollary 4. However, based on 1) alone, it is impossible for non-BUG candidate r7c5=7 to have r7c5=6 as an outcome. IOW r7c5=7 implying r7c5<>7 would not be based on the BUG principle.
>
> The first part is true, placing r7c5=6 leads to a BUG+1 and r7c5=6 is a valid move, so this move does not contradict corollary 4 in any way. I have no idea what you are trying to say with the last two sentences...

I'm saying, for the example under discussion, that corollaries 2 and 4 are contradictory. Hence, both cannot follow from the one theorem.

here Jeff wrote:

> **Corollary 2**: Any deductions implied by all non-BUG candidates in the grid must be valid. *(example)*
>
> **Corollary 4**: Any placement of a candidate which forces a grid into a BUG+1 is a valid move. *(example)*

RW wrote:

> **ronk wrote:**

> 1) We have a valid BUG+5, so we know at least one of the non-BUG candidates must be true. However, only one of the non-BUG candidates might ultimately be true ...
>
> Please explain the last sentence. Can I assume the same for my BUG+31?

Does the word *might* not show up on your monitor? Please explain how a BUG+31 might be useful.

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David P Bird

Posted: Mon Jul 27, 2009 3:07 am Post subject: quote

Joined: 16 Sep 2008
Posts: 130
Location: Middle England

RW, I take your point. You've made a good distinction of the differences between an Unavoidable Set and a Deadly Pattern which escaped me.

Your definition of Unavoidable Set is fine, but I think your definition of Deadly Pattern could be improved. How about:

A Deadly Pattern is a set of cells with member candidates that occur twice in each house they occupy.
It therefore follows that your "root members" make up the DP pattern while my "disruptors" are external to it.

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RW

Posted: Mon Jul 27, 2009 4:49 am Post subject: quote

Joined: 16 Mar 2006
Posts: 981
Location: Finland

> **ronk wrote:**
>
> I'm saying, for the example under discussion, that corollaries 2 and 4 are contradictory. Hence, both cannot follow from the one theorem.
>
> > **here Jeff wrote:**
> >
> > **Corollary 2**: Any deductions implied by all non-BUG candidates in the grid must be valid. *(example)*
> >
> > **Corollary 4**: Any placement of a candidate which forces a grid into a BUG+1 is a valid move. *(example)*

Sorry, I can't see your point. "Any deductions implied by all non-BUG candidates in the grid must be valid" is not the same as "any valid deduction must be implied by all non-BUG candidates". Seems to me that your placement is only contradictory with the second (false) styatement of the above...

> **ronk wrote:**
>
> Does the word *might* not show up on your monitor?

Sorry, misunderstanding...

> **ronk wrote:**

> Please explain how a BUG+31 might be useful.

AFAIK it should grant me a place in Guiness Book of World Records for biggest found BUG (so far)...

David P Bird wrote:

> How about:
>
> A Deadly Pattern is a set of cells with member candidates that occur twice in each house they occupy.

That would drastically change the meaning of the term "Deadly Pattern". With such a definition it would no longer necessarily imply multiple solutions... Actually, according to the current definition, Deadly Patterns should not be associated with BUGs. If you remove all + candidates from a BUG+n in a valid puzzle, you are never left with a pattern that has multiple solutions. You are left with a pattern that has 0 solutions. BUG-lites, on the other hand, always leavea deadly pattern if you remove all + candidates.

Also, if we went with your definition, we would lose the connection to the unavoidable set. If we for example remove all digits from this minimal unavoidable set:

Code:

```
*-----------*
|..7|.96|234|
|923|4..|..5|
|.65|283|71.|
|---+---+---|
|..1|8.9|.63|
|.89|.34|...|
|346|.15|92.|
|---+---+---|
|.9.|.58|1..|
|5.8|14.|.96|
|1..|...|.5.|
*-----------*
```

(Valency 6 unavoidable found by Red Ed here.)

we are left with the following possibilities:

Code:

```
*-------------------------------------------------------------*
| .     .     67    | .     49    69    | 27    23    34    |
| 39    29    35    | 24    .     .     | .     .     45    |
| .     26    57    | 28    38    36    | 17    15    .     |
|-------------------+-------------------+-------------------|
| .     .     1389  | 18    .     389   | .     369   36    |
| .     48    389   | .     39    348   | .     .     .     |
| 139   46    1369  | .     15    45    | 29    239   .     |
|-------------------+-------------------+-------------------|
| .     89    .     | .     15    58    | 19    .     .     |
| 159   .     189   | 14    48    .     | .     69    56    |
| 15    .     .     | .     .     .     | .     15    .     |
*-------------------------------------------------------------*
```

Not a deadly pattern according to your definition...

RW

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ronk

Posted: Mon Jul 27, 2009 6:46 am Post subject: quote

Joined: 02 Nov 2005
Posts: 2489
Location: Southeastern USA

> **RW wrote:**
> "Any deductions implied by all non-BUG candidates in the grid must be valid" is not the same as "any valid deduction must be implied by all non-BUG candidates". Seems to me that your placement is only contradictory with the second (false) styatement of the above...

A valid converse statement must preserve the context, as in ...

"any valid deduction based on the BUG principle must be implied by all non-BUG candidates"

Exactly how would this corrected converse statement be false?

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RW

Posted: Mon Jul 27, 2009 7:58 am Post subject: quote

Joined: 16 Mar 2006
Posts: 981
Location: Finland

Okay, I see what you're aiming at. Your example proves that it isn't a corollary. But it still doesn't prove that the assumption of corollary 4 is false. For that I think you need my example.

RW

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David P Bird

Posted: Mon Jul 27, 2009 8:56 am Post subject: quote

Joined: 16 Sep 2008
Posts: 130
Location: Middle England

RW, I seem to be giving you a hard time with all the corrections you are having to make to my assertions, but thank you, and I'm learning.

I realise that I'm considering a subset of deadly patterns with only two root candidates per cell. The one of Red Ed's you provided is a combination of several of these - it's quite remarkable. Hence my definition won't do in general, because it's too narrow.

However you would need to convince me that for solving purposes I would ever need to use a DP which supported more than two solutions.

I'm afraid I couldn't follow some of your points, but I don't think it matters. Happily I believe my use of the term hasn't been wrong so far, as my subsets are still DPs. I'll save my plans for an uprising against the flagrantly bad terminology we've

adopted for another day.

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