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Strong inferences induced by the UR

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Author	Message

Myth Jellies

Joined: 19 Sep 2005
Posts: 623

[] Posted: Mon Jul 20, 2009 9:51 pm   Post subject: [quote]

Just yesterday I started filling in candidates for the first two digits I was considering in a puzzle, and came up with something like the following in columns 789...

Code:

```
  .   .   . | .   .   . | ab   .   ab
  .   .   . | .   .   . | a    .   .
  .   .   . | .   .   . | a    .   .
 -----------+----------+-------------
  .   .   . | .   .   . | .    a   .
  .   .   . | .   .   . | .    .   .
  .   .   . | .   .   . | .    b   .
 -----------+----------+-------------
  .   .   . | .   .   . | b    .   .
  .   .   . | .   .   . | b    .   .
  .   .   . | .   .   . | ab   .   ab
```

...and using the UR in r19c79 and its resultant strong link (a)r23c7=(b)r78c7 along with the hidden pair in column 9, I immediately solved for a & b in column 9 without needing any more digits. I like it when you can make deductions on the fly as you are filling in candidates like that.

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RW

Joined: 16 Mar 2006
Posts: 981
Location: Finland

[] Posted: Mon Jul 20, 2009 9:55 pm   Post subject: [quote]

daj95376 wrote:

However, I ran across this PM this morning...

Code:

```
+--------------------------------------------------+
|   4     5     8   |   12    12    6   |   3     7     9   |
```

```
|   3      6      7    |   4      8      9    |   5      12     12   |
|  *1      9     *2    |   7      3      5    |   8      6      4    |
|------------------+------------------+------------------|
|  89      18     3    |   6      7      4    |  129     5      12   |
|  79     127     4    |   5      12     3    |  19      8      6    |
|   6      12     5    |   8      9      12   |   7      4      3    |
|------------------+------------------+------------------|
|  27      37     9    |  123     6      8    |   4      12     5    |
| -28      4     *1    |   9      5      27   |   6      3      78   |
|   5      38     6    |  13      4     127   |  12      9      78   |
+----------------------------------------------------------+
```

That's one very beautiful Reverse-BUG! 😃

RW

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Myth Jellies   📄 Posted: Mon Jul 20, 2009 10:32 pm   Post subject: [quote]

Joined: 19 Sep 2005
Posts: 623

edit-doh, RW beat me to the punch.

Code:
```
+----------------------------------------------------------+
|   4      5      8    |   12     12     6    |   3      7      9    |
|   3      6      7    |   4      8      9    |   5      12     12   |
|  #1#     9    #2#    |   7      3      5    |   8      6      4    |
|------------------+------------------+------------------|
|  89      18     3    |   6      7      4    |  129     5      12   |
|  79     127     4    |   5      12     3    |  19      8      6    |
|   6      12     5    |   8      9      12   |   7      4      3    |
|------------------+------------------+------------------|
|  27      37     9    |  123     6      8    |   4      12     5    |
| -28      4    #1#    |   9      5      27   |   6      3      78   |
|   5      38     6    |  13      4     127   |  12      9      78   |
+----------------------------------------------------------+
```

For this grid, the easiest technique to apply is reverse uniqueness. Look at the solved cells for 1 & 2. If r8c1 solves to a 2 then you form an unavoidable set with your solved cells. Thus your unsolved cells must also form an unavoidable set as well, and since you don't have a 1 or a 2 solved for in those cells, there will be no way that you can resolve them one way or the other. Thus r8c1 <> 2 and the puzzle is solved.

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David P Bird   📄 Posted: Tue Jul 21, 2009 2:13 am   Post subject: [quote]

Joined: 16 Sep 2008
Posts: 138
Location: Middle England

daj95376, to explain what I'm talking about using an example, here is a classic BUG pattern with the deadly pattern candidates ordered left and right to show the two potential solutions:
Code:
```
|----------------|----------------|----------------|
```

```
|            15       |               | 51           |
|                     |               |              |
|  53    31           |               | 15           |
|---------------------|---------------|--------------|
|            51+6     |               |          15  |
|                     |               |              |
|  35+6  13           |               |          51  |
|---------------------|---------------|--------------|
|                     |               |              |
|                     |               |              |
|                     |               |              |
|---------------------|---------------|--------------|
```

All the deadly pattern digits are present and we know one of the 6s shown in box 4 must be true to disrupt it, which will exclude any other 6 in the box. This is valid because the deadly pattern would make an unavoidable set which would require a given to resolve which of the alternative solutions is correct.

Even if we have been able to exclude one of the DP digits from either of the cells with the extra 6, the deduction is still valid though. As MJ has written, we can imagine that the deletion hasn't been made and arrive at the deduction using uniqueness. Alternatively we can say because we have been able to make the exclusion we have proved these cells are not an unavoidable set containing just the DP digits, so must contain a further digit. This second line of reasoning actually doesn't require uniqueness to be assumed unless it was used to make one of the earlier eliminations.

With a missing DP digit however, the pattern becomes far, far harder to identify, and I can't recall any earlier example ever being given. (My suspicion is that all such cases will succumb to AICs without needing to go through these mental contortions.)

This is an extension of what happened to a UR in my solution path to Storm_Norm's example earlier in this thread using 10 cells rather than 4.

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aran   Posted: Tue Jul 21, 2009 5:47 am   Post subject: [quote]

Joined: 02 Mar 2007
Posts: 356

> **Myth Jellies wrote:**
> Aran,
> I think there is an advantage to using your approach that will become apparent when one attempts to incorporate more than two digits in an extended uniqueness deduction--an area that hasn't received a lot of attention in recent times.

Further to that Myth I think this ought to be true as a general statememt :
take any sets of cells that are in uniqueness formation
then those cells cannot be occupied by perfect fish alone.

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daj95376   Posted: Tue Jul 21, 2009 6:47 am   Post subject: [quote]

Joined: 15 May 2006
Posts: 1487

RW and Myth Jellies: I may have made a terrible mistake by not including the original puzzle. My apologies!!!

Code:

```
+-----------------------+
| 4 . 8 | . . 6 | . . 9 |
| . . 7 | . . . | . . . |
| 1 9 . | 7 . . | 8 6 4 |
|-------+-------+-------|
| . . 3 | 6 7 . | . 5 . |
| . . . | 5 . . | . 8 . |
| 6 . . | . . . | 7 . . |
|-------+-------+-------|
| . . 9 | . . 8 | 4 . . |
| . . 1 | 9 5 . | . . . |
| 5 . 6 | . . . | . . . |
+-----------------------+
```

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Myth Jellies

Joined: 19 Sep 2005
Posts: 623

Posted: Tue Jul 21, 2009 10:43 pm   Post subject: [quote]

Nothing terrible about it, daj. One can see from your starting grid that, because of reverse uniqueness, there is a weak link between (2)r3c3 and (2)r8c1. This weak link will hold throughout the puzzle no matter how many candidates get eliminated and digits get filled in. (Of course that relationship is rendered meaningless if you manage to eliminate 2 as an option from one of those cells)

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RW

Joined: 16 Mar 2006
Posts: 981
Location: Finland

Posted: Tue Jul 21, 2009 11:23 pm   Post subject: [quote]

Thanks for the puzzle daj. One of the best reverse-BUG examples I've seen to date. This ER 7.2 puzzle reduces to only a couple of pairs using the reverse-BUG (which isn't obvious in the starting grid, but does appear after the first pair).

RW

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Myth Jellies

Joined: 19 Sep 2005
Posts: 623

Posted: Wed Jul 22, 2009 5:04 pm   Post subject: [quote]

My apologies for taking this thread on a tangent for a bit here.

DPB,

Here is a grid that ronk and Nick67 worked on in the BUG thread (4th page) a few years ago....

Code:

```
+-------------+---------------+----------+
| 569   8   45 | 46   1    59 | 2   3   7 |
```

```
| 7     46   2  | 3     468  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    678 | 47   5    1  |
+--------------+----------------+----------+
| 2     9    1  | 8     67   67  | 3    4    5  |
| 3     7    8  | 2     5    4   | 1    9    6  |
| 56    46   45 | 1     39   39  | 8    7    2  |
+--------------+----------------+----------+
```

If you note the three 7's in bivalued cells in column 5, it is obvious that there won't
be a simple full grid BUG. After a few missteps and some suggestions by Jeff,
Nick67 came up with the following offering...

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    |
*----------------------------------------------------*
```

Nick67's idea was that you could still keep the form of a full BUG grid if you allowed
bivalues to contribute BUG options as well. Of course this adds extra BUG choices
that need to be assessed, and it is not very easy to figure out. DPB's idea is in some
ways related to Nick's. If we "simply" add some extra candidates...

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    *79   1   | 8    *56+7*47+6| 3   *94  *65  |
| 3    *97   8   | 2    *65  *74  | 1   *49  *56  |
| 56    46   45  | 1     39   39  | 8    7    2    |
*----------------------------------------------------*
```

...we can turn this into a more familiar BUG grid form. Again, we still have the same
extra options to consider and it is not easy. I'm not sure if a better full grid is out
there to find.

Back in the day, I hadn't proposed BUG-lites yet; but, another option is to avoid the

cells causing you problems and consider a mega-BUG-Lite (consider the starred cells only)...

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    67   67   | 3    4    5   |
| 3     7    8   | 2    5     4   | 1    9    6   |
|*56   *46  *45  | 1   *39   *39  | 8    7    2   |
*---------------------------------------------*
```

Essentially of similar difficulty to find in this case, but it does not introduce new BUG avoidance options.

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ronk

Joined: 02 Nov 2005
Posts: 2492
Location: Southeastern USA

Posted: Wed Jul 22, 2009 6:12 pm   Post subject: [quote]

[edit: Dang, I blew away this post while writing the later one. Not sure if I'll try to reconstruct it.]

Last edited by ronk on Thu Jul 23, 2009 7:45 am; edited 2 times in total

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PIsaacson

Joined: 02 Jul 2008
Posts: 193
Location: Campbell, CA

Posted: Wed Jul 22, 2009 6:58 pm   Post subject: [quote]

Myth,

I'm wondering the same thing as Ron. According to my solver, there are multiple solutions for the PM with the added candidates. Surely that makes any inferences based on BUG or UR invalid???

Confused,
Paul

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RW

Joined: 16 Mar 2006
Posts: 981
Location: Finland

Posted: Wed Jul 22, 2009 8:51 pm   Post subject: [quote]

PIsaacson wrote:

> Myth,
>
> I'm wondering the same thing as Ron. According to my solver, there are multiple solutions for the PM with the added candidates.

Yes, because they have removed at least one clue and left rows 7 and 8 with a reverse BUG-lite:

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     79  *1   |*8     56+7  47+6|*3    94   65   |
|*3     97  *8   |*2     65    74  |*1    49   56   |
| 56    46   45  | 1     39    39  | 8    7    2    |
*-----------------------------------------------*
```

Thanks to this, you can immediately tell that row 7 and 8 has at least two solutions.

I would suggest that if you are to invent candidates, you are not allowed to remove given clues.

RW

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Myth Jellies

Joined: 19 Sep 2005
Posts: 623

🗋 Posted: Wed Jul 22, 2009 10:05 pm　　Post subject:　　　　　🔲 quote

It is like adding zero to an equation; or, more precisely OR'ing in Booleans that I already know to be false. So it is legit as long as I am careful.

if (not B), then A equals (A or B)

I never really consider that any of these added candidates could actually be true--I only add them in to help me see a pattern. Once the pattern is spotted, I can immediately wipe them all out again.

RW has the gist of it. You can't remove a given without risk of introducing extra incorrect solutions unless you have proven that the given is superfluous.

Ron, I don't think anyone ever presented the original puzzle in that thread.

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aran

Joined: 02 Mar 2007
Posts: 356

🗋 Posted: Thu Jul 23, 2009 6:29 am　　Post subject:　　　　　🔲 quote

RW 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     79    *1  | *8     56+7  47+6| *3    94    65  |
| *3     97    *8  | *2     65    74  | *1    49    56  |
| 56     46    45  | 1      39    39  | 8     7     2   |
*------------------------------------------------------*
```

Thanks to this, you can immediately tell that row 7 and 8 has at least two solutions.

I would suggest that if you are to invent candidates, you are not allowed to remove given clues.

RW

RW
What a clever deduction 😃
On first reading I didn't see how you could reach that conclusion without knowing about the givens. But the post to which you gave the link provided the answer : ie in this configuration (2 rows within the same boxes) if there is an unavoidable set (regardless of givens) then the unfilled cells also form an unavoidable set which is impossible for a unique solution.
As to inventing candidates, I see no issue with that (as Myth has already said).

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ronk

Joined: 02 Nov 2005
Posts: 2492
Location: Southeastern USA

Posted: Thu Jul 23, 2009 7:41 am   Post subject: [quote]

Myth Jellies wrote:

After a few missteps and some suggestions by Jeff, Nick67 came up with the following offering...

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   |
*------------------------------------------------------*
```

...
If we "simply" add some extra candidates...

It doesn't answer **David P Bird**'s question, of course, but we could use **Jeff**'s ...

Corollary 4 : *Any placement of a candidate which forces a grid into a BUG+1 is a valid move.* *(example)*

... and set r7c5=6.

[edit: r7c5 was typo r8c5]

Last edited by ronk on Fri Jul 24, 2009 7:38 am; edited 1 time in total

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