Sudoku Players' Forums

Alternating Inference Chains

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Author	Message
wintder Joined: 24 Apr 2007 Posts: 318	Posted: Tue Jun 19, 2007 7:05 pm Post subject: quote I thank you for your post on AIC. I am just starting to look at it and got lost on the example below. There are two "B"s missing and a "C" as well as the end link of the AIC. If I knew what I was doing I could figure it out, but I don't, sigh.

Myth Jellies wrote:

Next is a recent Ruud Daily Nightmare
Code:

```
ALS example
*-----------*
|.6.|5..|.1.|
|...|3..|..4|
|..8|.9.|2..|
|---+---+---|
|4.7|2..|...|
|.5.|.7.|.8.|
|...|..9|1.7|
|---+---+---|
|..3|.4.|6..|
|1..|..7|...|
|.8.|..5|.2.|
*-----------*
*-------------------------------------------------------------------*
| 2379 6 49 | 5 28 48 | 3789 1 389 |
| 259 179 159 | 3 1268 168 | 589 79 4 |
| 35 14 8 | 7 9 14 | 2 356 356 |
|---------------------+---------------------+---------------------|
| 4 A139 7 |-2 -1568 -1368 | 359 3569 3569 |
|A69 -5 A169 | 146 7 B36 | 349 8 2 |
| 8 23 26 | 46 56 9 | 1 3456 7 |
|---------------------+---------------------+---------------------|
| 59 79 3 | 18 4 2 | 6 579 18 |
| 1 249 24569 | 689 36 7 | 34589 3459 3589 |
| 679 8 469 | 169 136 5 | 3479 2 139 |
*-------------------------------------------------------------------*
A3=A(1&6&9)-B6=B3

alternate notation when you don't have a picture
3[r4c2,r5c13]=(1&6&9)[r4c2,r5c13] - 6[r5c6]=3[r5c6]
sparse notation (non-endpoint candidate premise or location given only when changed)
3[r4c2,r5c13] = (1&6&9) - 6[r5c6] = 3[r5c6]
```

> The second candidate premise (1&6&9) asks do the three cells marked with a B contain 1, 6, and 9? If that is true, then since all the 6's in B lie on row 5, the weak inference with other 6's in the row would apply. The chain means that all the cells seeing both C and A cannot be 3's.

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Myth Jellies

Joined: 19 Sep 2005
Posts: 623

Posted: Tue Jun 19, 2007 10:56 pm Post subject: quote

Thanks for the heads up. Fixed bad comments. Replaced my goofy notation with the Eureka notation.

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wintder

Joined: 24 Apr 2007
Posts: 318

Posted: Tue Jun 19, 2007 11:48 pm Post subject: quote

I understand your post now.

It was relevant and very good.

Thanks Myth Jellies!

Last edited by wintder on Thu Jun 28, 2007 8:52 pm; edited 2 times in total

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RW

Joined: 16 Mar 2006
Posts: 981
Location: Finland

Posted: Wed Jun 20, 2007 12:02 am Post subject: quote

windter wrote:

> I regret my posting because your "excellant post for newbies" AIC post is not now readable,
> in the sense, discernable to most people. It used to be very good, maybe is still good, I cannot read it.

Don't give up quite yet. Here's the old and the new version of the chain in Myth's first example:

Code:

```
alternate notation when you don't have a picture
8[r9c6]=8[r9c7] - 5[r9c7]=5[r8c8] - 5[r3c8]=5[r3c5] - 8[r3c5]=8[r3c2] -
8[r1c3]=8[r8c3]

Eureka notation:
(8)r9c6 = (8-5)r9c7 = (5)r8c8 - (5)r3c8 = (5-8)r3c5 = (8)r3c2 - (8)r1c3
= (8)r8c3
```

If you look at that for a few seconds you should understand Eureka notation well enough to follow the post.

RW

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wintder

Joined: 24 Apr 2007
Posts: 318

Posted: Wed Jun 20, 2007 12:26 am Post subject: quote

Thanks RW.

Edited to add:

Thanks Myth Jellies.

Eureka notation
(3=1&6&9)r4c2,r5c13 - (6=3)r5c6

I now get it, thanks both!

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coloin

Joined: 05 May 2005
Posts: 1068
Location: Devon UK

Posted: Fri Oct 19, 2007 2:07 pm Post subject: quote

Steve K has apparently put forward a theory to ? solve the "Easter Monster" puzzle with AIC on Eureka here

Code:

```
1..|...|..2
.9.|4..|.5.
..6|...|7..
---+---+---
.5.|9.3|...
...|.7.|...
...|85.|.4.
---+---+---
7..|...|6..
.3.|..9|.8.
..2|...|..1



   1      A478     34578    | 3567    3689    5678    | 3489   I369     2
  L238     9      L378     | 4      K12368  K12678   |J138     5
J368
   23458  A248     6        | 1235    12389   1258    | 7      I139
 3489
 -------------------------+-------------------------+-----------------
-----
   2468    5       1478    | 9       1246    3       | 128    H1267
678
   234689 B12468   13489   | 126     7       1246    | 123589 H12369
 35689
     2369 B1267    1379    | 8       5       126     | 1239    4
 3679
 -------------------------+-------------------------+-----------------
-----
   7      C148     14589    | 1235    12348   12458   | 6      G239
 3459
  D456     3      D145     |E12567  E1246    9       |F245     8
F457
   45689  C468     2        | 3567    3468    45678   | 3459   G379     1


(27)r13c2=(27-16)r56c2=(16)r79c2-(16)r8c13=(16-27)r8c45=(27)r8c79-
(27)r79c8=(27- 16)r45c8=(16)r13c8-(16)r2c79=(16-27)r2c56=(27)r2c13 -
loop
```

```
Note that nodes marked A, C, D, F, G, I, J and L are all AALSs.
```

Please could someone run it by me again !!

Will this technigue apply to other similar puzzles ?

C

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ronk

Posted: Fri Oct 19, 2007 6:26 pm Post subject: quote

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

coloin wrote:

> Will this technigue apply to other similar puzzles ?

It's an available opening move in these 14 non-equivalents selected from **Ocean's** post **here**.

Code:

```
1.......2.3..4..5...6...7.....1.3....4..8..9....4.5.....7...1...8..3..4.2.......6
# ER=9.9
1.......2.3..4..5...6...7.....1.4....8..7..4....5.8.....7...6...5..3..8.2.......1
# ER=9.9
1.......2.3..4..5...6...7.....1.3....4..6..8....9.4.....7...1...5..9..3.2.......6
# ER=9.8
1.......2.3..4..5...6...7.....1.3....8..7..3....5.8.....7...6...5..3..8.2.......1
# ER=9.8
1.......2.3..4..5...6...7.....1.4....4..7..8....9.5.....7...6...5..9..3.2.......1
# ER=9.8
1.......2.3..4..5...6...7.....1.4....8..7..4....5.3.....2...6...4..5..3.7.......1
# ER=9.8
1.......2.3..4..5...6...7.....1.4....8..9..4....5.8.....2...1...5..3..8.7.......6
# ER=9.8
1.......2.3..4..5...6...7.....1.3....8..5..4....4.9.....7...1...4..3..8.2.......6
# ER=9.7
1.......2.3..4..5...6...7.....1.4....5..2..4....5.3.....2...6...4..8..3.7.......1
# ER=9.6
1.......2.3..4..5...6...7.....1.3....4..2..3....5.4.....7...6...5..8..4.2.......1
# ER=9.5
1.......2.3..4..5...6...7.....1.3....4..7..8....4.5.....7...6...8..5..3.2.......1
# ER=9.5
1.......2.3..4..5...6...7.....1.3....5..7..4....4.8.....2...1...4..8..3.7.......6
# ER=9.5
1.......2.3..4..5...6...7.....1.3....5..7..8....5.4.....7...6...4..5..3.2.......1
# ER=9.5
1.......2.3..4..5...6...7.....1.4....8..2..4....5.8.....2...6...4..3..8.7.......1
# ER=9.5
```

[edit: changed link to post instead of to page]

Last edited by ronk on Sat Feb 09, 2008 3:44 am; edited 1 time in total

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AW

Posted: Sun Oct 21, 2007 10:49 am Post subject: quote

Joined: 31 Jan 2007
Posts: 27

I was going to post this on Eureka, but the boards are down this week-end.

Stephen's deduction is anything but a conventional AIC. In fact, without extending conventional AIC wisdom, it's not an AIC at all. More like an alternating set chain. The problem with interpreting it as an AIC is that it doesn't rely on the same kinds of inferences. Conventional AICs alternate between "not both false" and "not both true" inferences, but these notions don't apply here. In this new case, the AIC does not transport one truth : it transports 2 truths at the same time. Basically, it extends the chain patterns to accounting for inference sets that transport two truths at once. And it could be further extended to an arbitrary number of truths.

There are generic formulas for shaking up sets, but I don't want to elaborate on those. Just for example, here's the formula to split a set :
AB{m:n} - A{x:y} = B{m-y:n-x}, with any required adjustments to keep all variables within a reasonable range of values (there's the obvious lower bound of 0, the obvious upper bound of the number of possible truths in the set, etc.).
Meaning : if you extract from set 'AB', that has at least 'm' truths and at most 'n' truths in it, a subset 'A' that has at least 'x' truths and at most 'y' truths, then the remaining subset 'B' must have at least 'm-y' truths and at most 'n-x' truths (plus adjustments).

To get a general idea of the principle, here are a couple examples :

In a very basic AIC case (where all the strong inferences are conjugates, and all the weak inferences are same-cell or same-unit-number) :
A strong inference is 'A = B' where the AB set is {1:1} (exactly one is true).
A weak inference is 'A - B' where the AB set is {0:1} (at most one is true).
So the sets push around the truth like so :
Either A is {0:0}, and we get : A{0:0} = B{1:1} - C{0:0} = D{1:1} - E{0:0} ... = Z{1:1}
Or A is {1:1}, and we get : A{1:1} = B{0:0} - C{0:1} = D{0:1} - E{0:1} ... = Z{0:1}

In Stephen's deduction (where the case is pertty basic for N=2, all strong inferences correspond to pairwise conjugates) :
A strong inference is 'A = B' where the AB set is {2:2} (each holds exactly two true candidates).
A weak inference is 'A - B' where the AB set is {0:2} (each holds at most two true candidates).
The A set has three possibilities :
Either A is {0:0}, and we get : A{0:0} = B{2:2} - C{0:0} = D{2:2} - E{0:0} ... = Z{2:2}
Or A is {1:1}, and we get : A{1:1} = B{1:1} - C{0:1} = D{1:2} - E{0:1} ... = Z{1:2}
Or A is {2:2}, and we get : A{2:2} = B{0:0} - C{0:2} = D{0:2} - E{0:2} ... = Z{0:2}

The applicable AIC deductions in the "N=2" case are :
Strong loop : If A and Z are actually the same set, then A must be a {2:2} set (since AZ is either {2:2}, {2:3} or {2:4}). It's the great attractor : any truths taken out of A transport back to it.
Regular loop : If there is a weak inference between A and Z, then AZ must be a {2:2} set, and recursively all inference sets in the chain must be {2:2}. Blind justice, all inferences are assimilated.
Weak loop : If there is a set X such that A - X - Z (weak inferences to A and Z), then ... well this one is funny : we conclude that X is {0:1} (the gray hole : A and Z siphon truths away from X but they do so independently; any truths taken out of A transport to Z, but in the worse case both hold one truth and these target the same candidate in X, so X is still left with one truth.)

In the general case, for sets 'N' : we have strong inferences of at least N truths, and weak inferences of at most N truths.
The strong loop forces A into a {N:N} set.
The regular loop forces all inference sets into {N:N} sets.
The weak loop makes any target set into a {0:N/2 rounded down} set. This conveniently works out to {0:0} when N=1.

Well known patterns can usually be interpreted as cases of set transport :
Basic chains have already been looked at, when N=1. I'll only add that ALS and other original means of transport fall under the set-shaking formulas as well.
Interactions and singles are single inference set patterns with N=1 : AB{1:1} - (A{1:1} = B{0:0}.
Bigger set patterns are single inference set patterns with N>1. For instance, a swordfish relies on AB{3:3} - A{3:3} = B{0:0}.
Set overlap wreaks havoc in all cases, but can be tractable : like the X in the weak loop, some information can still be used, although I usually can't get my head around it.

Stephen's deduction is a simple case of chaining sets where N=2. Its simplicity is what makes it amazing : there are only two truths transported, the weak(cover) sets consistently alternate between cell pairs and boxes, and the strong(base) sets consistently alternate between number pairs in rows and columns, and there is no nasty overlap.
Here's a matrix representating the deduction as both a chain and a set problem, for those who are familiar with these constructs :

Code:

```
       | (27)b1    r56c2     (16)b7    r8c45     (27)b9    r45c8
 (16)b3    r2c56
-------+-------------------------------------------------------------------
---------------
(27)c2 |(27)r13c2 (27)r56c2
(16)c2 |          (16)r56c2 (16)r79c2
(16)r8 |                    (16)r8c13 (16)r8c45
(27)r8 |                              (27)r8c45 (27)r8c79
(27)c8 |                                        (27)r79c8 (27)r45c8
(16)c8 |                                                  (16)r45c8
(16)r13c8
(16)r2 |
(16)r2c79 (16)r2c56
(27)r2 |(27)r2c13
     (27)r2c56
-------+-------------------------------------------------------------------
---------------
       |(Put the column remainders down here, they are the eliminated.)

Where rows are "at least two" sets (well, actually, "exactly two" in
this case), and columns are "at most two" sets.
```

As a side note, Stephen's alternations between cell-box and row-column suggest this pattern has affinities with braiding. Perhaps an interesting pattern can emerge from studying this.

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Steve K

Posted: Sun Oct 21, 2007 11:47 am Post subject: quote

In order to chain the deduction using AIC properly, one probably needs to consider two simul

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

chains.

First, for all cases where 2 candidates are limited to four locations within a group, one proper way to use this relationship as an AIC fragment is:
((Can1)loc12=(Can2)loc12)=(Can1&2)loc34

Using this piece of information, construct two simul chains, both very similar to each other:

Generally, (A=B)=(A&B)-(C=D)=(C&D).....

and

(A&B)=(A=B)-(C&D)=(C=D)

One needs to alternate not only the =,- as with standard AIC, but also the contained =,&. One chain leads with contained= and ends with contained & while the other leads with & and ends with contained &. This is more or less the meaning behind saying that it really is a hidden pair loop, as one proper way to chain hidden pairs is this way.

The chain ends (all of them) will be completely symmetric, and will have simultaneous:

(A&B)loc12=-(A=B)loc34 and (A=B)loc12=-(A&B)loc34. There are three ways to satisfy this set of proven conditions:

(The truth table is built upon the contained Booleans, not A,B)

T,F,T,F
F,T,F,T
F,T,T,F

(Note T,F,F,T is clearly impossible)
The first two clearly will justify all the eliminations, while the latter is possible only if both A&B exist at loc1234. This still justifies the eliminations.

Note, although a hidden pair is (A&B) at loc 12, a hidden pair loop really wants the more general partitions: (A&B)=(A=B), and that both partitions co-exist as chainable fragments.

In any event, sans using a matrix to prove the point, this is the best description that I have at this point.

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ttt

Posted: Sat Nov 10, 2007 7:48 am Post subject: quote

Joined: 20 Oct 2006
Posts: 209
Location: vietnam

Deleted...

Last edited by ttt on Thu Jul 16, 2009 9:26 pm; edited 1 time in total

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ttt

Posted: Thu Jul 16, 2009 9:25 pm Post subject: quote

Joined: 20 Oct 2006
Posts: 209
Location: vietnam

Hi All,
This puzzle GN05 from here that posted by **gpenet** - **champagne**.

Code:

```
 *-----------*
 |...|...|..1|
 |...|..2|34.|
 |..3|...|56.|
 |---+---+---|
 |..5|..6|.2.|
 |.7.|.1.|...|
 |8..|4..|...|
 |---+---+---|
 |..9|..3|6..|
 |.4.|.7.|...|
 |1..|8..|...|
 *-----------*
 *-------------------------------------------------------------------------
-------*
 | 245679  25689   24678   | 35679   345689  45789   | 2789    789
1       |
 | 5679    15689   1678    | 15679   5689    2       | 3       4
789     |
 | 2479    1289    3       | 179     489     14789   | 5       6
2789    |
 |-------------------------+-------------------------+-----------------
-------|
 |C349    C139     5       |D379    D389     6       | 14789   2
34789   |
 |B23469   7       A246    |E2359    1       F589    | 489     3589
345689  |
 | 8       B12369  A126    | 4       E2359   F579    | 179     13579
35679   |
 |-------------------------+-------------------------+-----------------
-------|
 |K257    K258     9       |J125    J245     3       | 6       1578
24578   |
 |L2356    4       M268    |H12569   7       G159    | 1289    13589
23589   |
 | 1       L2356   M267    | 8       H24569  G459    | 2479    3579
234579  |
 *-------------------------------------------------------------------------
-------*
```

This puzzle seems to symmetry but the interesting of this one is "mini" SK loop that I have been ever seen before.
Look at 5 candidates 2, 3, 5, 6, 9 at 4 boxes 4, 5, 7, 8 :
1- On each box contains exactly 4 in 5 candidates 2, 3, 5, 6, 9 => we have 16 "true".
2- On each (B, E, H, L) contains maximum 2 in 5 candidates 2, 3, 5, 6, 9 – 2 "true".
3- On each (C & D), (F & G), (J & K), (M & A) contains maximum 2 in 5 candidates 2, 3, 5, 6, 9 – 2 "true".

(1) & (2) & (3) => on each B, E, H, L, (C & D), (F & G), (J & K), (M & A) contains exactly 2 "true" in 5 candidates 2,3,5,6,9.
=> r5c1<>4, r6c2<>1, r1c3<>26, r2c3<>6, r1c6<>59, r3c6<>9, r4c7<>9, r4c9<>39, r7c8<>5, r7c9<>25, r8c4<>1, r9c5<>4

I don't know how to present this as diagram like **ronk**'s. Please help me, thanks.

ttt

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ronk

Posted: Fri Jul 17, 2009 3:28 am Post subject: quote

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

ttt wrote:

This puzzle GN05 from here that posted by **gpenet** - **champagne**.

Code:

```
*-----------*
|...|...|..1|
|...|..2|34.|
|..3|...|56.|
|---+---+---|
|..5|..6|.2.|
|.7.|.1.|...|
|8..|4..|...|
|---+---+---|
|..9|..3|6..|
|.4.|.7.|...|
|1..|8..|...|
*-----------*
```

The above is a morph to **tarek**'s Pearly6000-1984 first published AFAIK as part of his **Pearly3045** in Dec 2007.

Code:

```
 7 . . | . . . | . . 1
 . 3 . | 9 . . | . 2 .
 . . 5 | . . . | 8 . .
-------+-------+-------
 . 6 . | 2 . 9 | . . .
 . . . | . 5 . | . . .
 . . . | 6 . 7 | . 4 .
-------+-------+-------
 . . 8 | . . . | 7 . .
 . 9 . | . . 4 | . 6 .
 1 . . | . . . | . . 5   # tarek's Pearly6000-1984
```

ttt wrote:

I don't know how to present this as diagram like **ronk**'s. Please help me, thanks.

You mean a graphic like **this**?

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ttt

Posted: Fri Jul 17, 2009 4:50 am Post subject: quote

Joined: 20 Oct 2006
Posts: 209
Location: vietnam

ronk wrote:

ttt wrote:

This puzzle GN05 from here that posted by **gpenet** - **champagne**.

The above is a morph to **tarek**'s Pearly6000-1984 first published AFAIK as part of his **Pearly3045** in Dec 2007.

Ah..., I didn't know that and I don't know how to "morph" the puzzle but this one is quite interested – at least for me, SK loop based on 5 candidates.

> **ronk wrote:**
>
> > **ttt wrote:**
> >
> > I don't know how to present this as diagram like **ronk**'s. Please help me, thanks.
>
> You mean a graphic like **this**?

No, I meant like this . Thanks

ttt

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champagne

Posted: Sat Jul 18, 2009 11:43 am Post subject: quote

Joined: 02 Aug 2007
Posts: 487
Location: France Brittany

> **ronk wrote:**
>
> The above is a morph to **tarek**'s Pearly6000-1984 first

I just discover that discussion. No doubt about my source. This is a mintext form of a puzzle included in the GSF taxonomy file.

I have lost part of the full id, but it starts with tarek-1984...

For the time being, it is the easiest puzzle having a SK loop in my database that's the reason why I proposed it as a study case.

champagne

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tarek

Posted: Sat Jul 18, 2009 2:14 pm Post subject: quote

Joined: 05 Jan 2006
Posts: 2244
Location: The Midlands, UK

> **champagne wrote:**
>
> > **ronk wrote:**
> >
> > The above is a morph to **tarek**'s Pearly6000-1984 first
>
> I just discover that discussion. No doubt about my source. This is a mintext form of a puzzle included in the GSF taxonomy file.
>
> I have lost part of the full id, but it starts with tarek-1984...

The 1st 3045 puzzles of the current pearly6000 were posted as the pearly3045 before adding the rest at a later date. The ID of each puzzles remains the same in both collections.

gsf added the pearly3045 collection to the q1 & q2 taxonomy lists with the same ID number

but with "tarek" instead of pearly3045.

The ID number remains the same in all 3 collections.

Hopefully this didn't distract anyone from the important work being discussed here or on the French forum

tarek

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