YAS – Yet Another Sudoku Documentation

Version 2.19

10/23/2020

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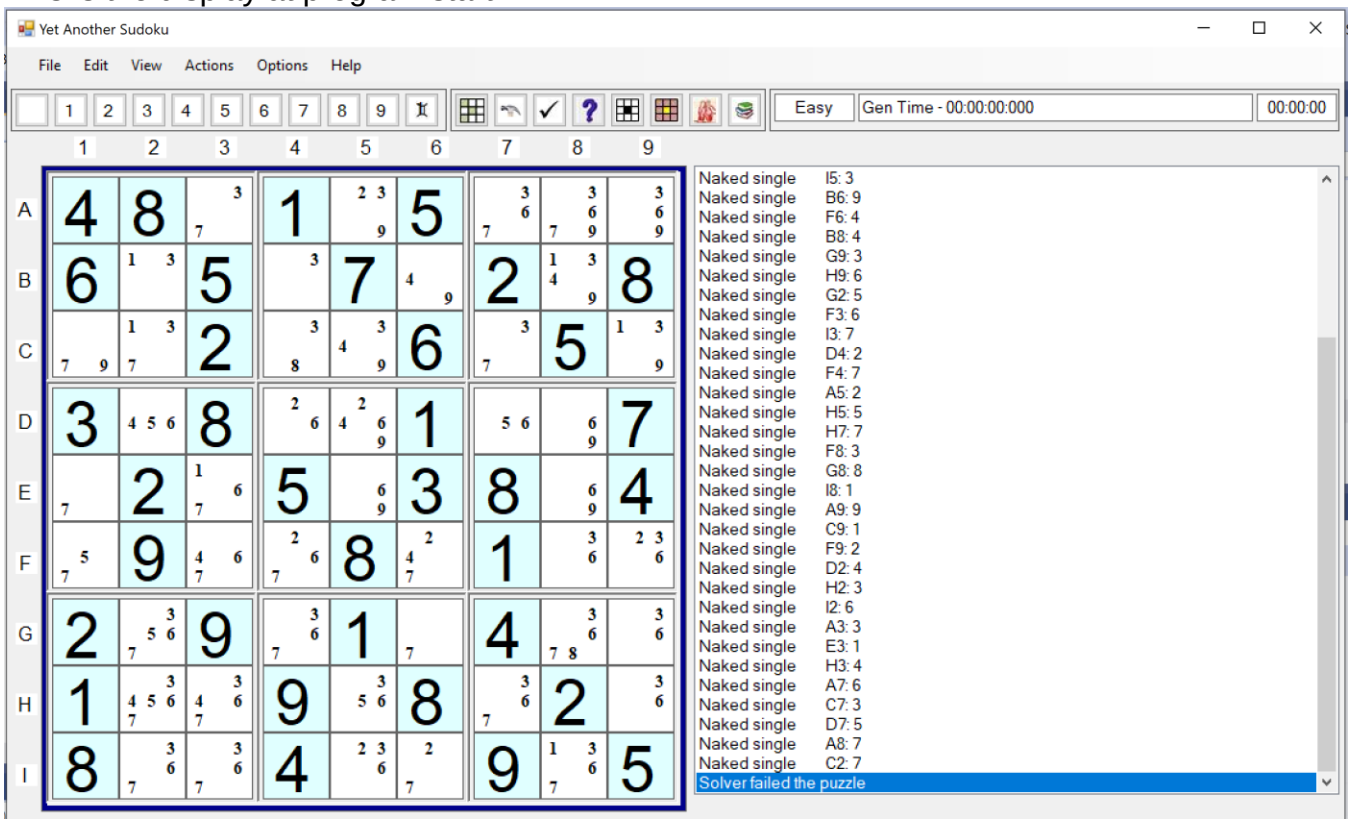
Description

General Description

After playing a number of Sudoku games on-line, I noticed that most had a few functions like Load, Generate, Check, Solve, Save, etc. but very few were more robust. HoDoKu seemed to be the best (http://hodoku.sourceforge.net/en/index.php). It's been around for a while so had time to mature. The source code in Java is available for downloading. The techniques section of the site contains an extensive list of solving methods and descriptions. I was a little disappointed in the display, but it's not built to be a Windows UI. Ah, well…can't have everything. I thought I'd go through it to see how the various solving methods were implemented. Alas, it's been a long time since I coded in Java. I'm currently using C# as I find it a natural outgrowth of 'C' which I had used extensively. So why not just write my own version in C# ?

Initial Display

This is the display at program start:



The Menu line is obvious. The next line has the Filter Panel, the Action Button Panel and the Status panel. Below that you see the Main Panel to the left and the display for the Advanced Solving Methods to the right.

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Menu Items

File

- **New**: Generates a new puzzle of the difficulty shown in the Difficulty box in the Status Panel (discussed later).
- **Open**: Opens a file and fills in the puzzle values. The file is a text-type file of either 1 line with 81 characters or 9 lines of 9 characters each. Each character position can be:
  - A number from 1-9 signifying a legitimate Solution number for that Row/Column position;
  - A Tilde ('~') which can be used as a separator to make the file more readable;
  - A Zero, letter or a symbol signifying no Solution number for that Row/Column position.
- **Save As**: Saves the puzzle as a file formatted as 9 Rows of 9 numbers with a Dash ("-") used to signify a non-Solution character entry.
- **Save**: Saves the puzzle using the last accessed File Name.
- **Exit**: Exits the program.

Edit

- **Undo**: Not yet implemented.
- **Redo** Not yet implemented.
- **Edit Blank Puzzle**: Displays a blank puzzle and allows the user to enter numbers in selected cells. Upon exit, the candidates are filled in the cells without a solution.
- **Edit Current Puzzle**: Displays the current puzzle without the candidates and allows the user to enter numbers in selected cells. Upon exit, the candidates are filled in the cells without a solution.

View

- **Filter Candidates**:
  - Filter on 1's: See *Filter Panel*
  - Filter on 2's: See *Filter Panel*
  - Filter on 3's: See *Filter Panel*
  - Filter on 4's: See *Filter Panel*
  - Filter on 5's: See *Filter Panel*
  - Filter on 6's: See *Filter Panel*
  - Filter on 7's: See *Filter Panel*
  - Filter on 8's: See *Filter Panel*
  - Filter on 9's: See *Filter Panel*
  - Filter on Pairs: See *Filter Panel*
- **Clear Filter**: See *Filter Panel*

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- **Green Marker**: See *Marker Menu Selection*
- **Pink Marker**: See *Marker Menu Selection*
- **Blue Marker**: See *Marker Menu Selection*
- **Amber**: See Marker *Menu Selection*
- **Remove Marker**: See *Marker Menu Selection*
- **Remove All Markers**: *See Marker Menu Selection*

Actions

Hints: See the *"Stack of Books" Action Button*
Show Next Step: See the *"Questionmark" Action Button*
Solve All 'Naked Singles: See the *"White Puzzle with Black Center" Action Button*
Reload Puzzle: Loads the previous puzzle into the Main Panel Display.
See Answers: Loads the previous solution into the Main Panel Display.
Check Puzzle: See the *"Checkmark" Action Button*
Solve Puzzle:

- **Dancing Links**: See the *"Ballet Shoes" Action Button*
- **Backtracking**: The Backtracking Method seeks a solution through repeated trial and error. If this method doesn't yield a solution, then there probably isn't one.
- **Advanced Methods**: These are performed successively until no more solutions are found:
  - **Naked Singles**: See the *"White Puzzle with Black Center" Action Button*
  - **Hidden Singles**: See the *"Brown Puzzle with Yellow Center" Action Button*
- **Kermalis Lib**: See the *"Stack of Books" Action Button*

Generate Puzzle: See the *"White Puzzle with Three Grey Blocks" Action Button*
Difficulty Level: See the *"Hammer" Action Button*

Options

Block Invalid Moves: Not yet implemented.
Show Candidates: If checked, shows the candidates in the unsolved cells.
Show Candidates While Filtering: Not yet implemented.

Help

Contents: Shows acknowledgements for codes' sources used.
About: Shows YAS version number.
Copyright: Copyright statement for the program

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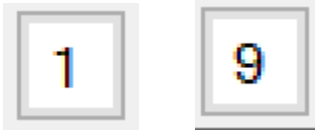
Filter Panel

The Filter Panel consists of 11 buttons:

Clear Filters 

Filter on numbers 1 – 9 

Filter on Pairs 

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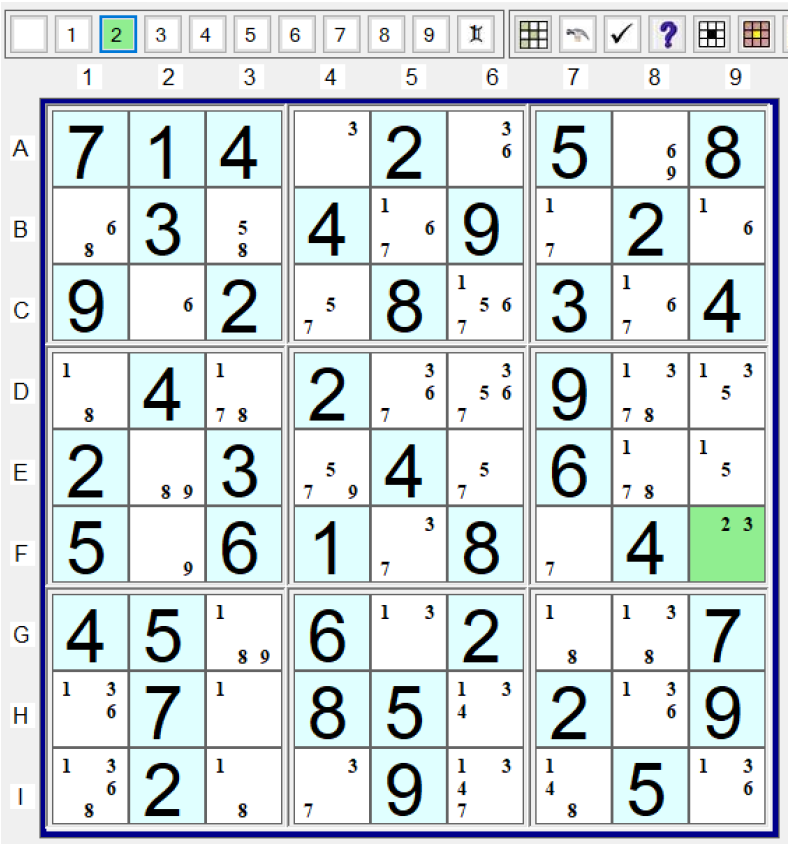
Selecting one of the number buttons will highlight in green any unsolved cells containing that number as a candidate. This is useful to show cells which are isolated and therefore can be set to that number as the cell solution. This is shown below for the number 2.



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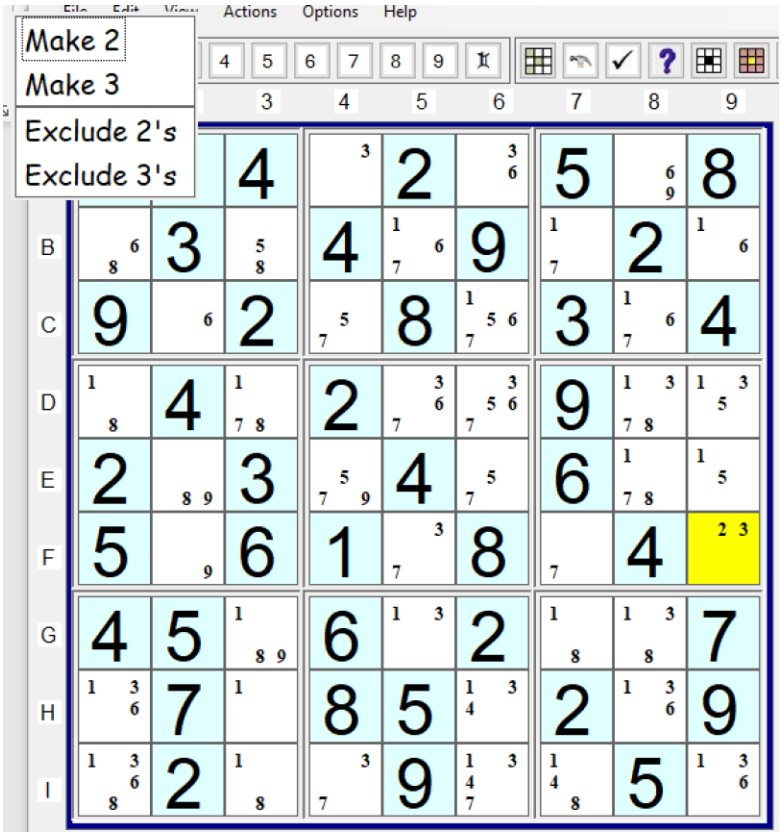
Selecting “2” as the solution is accomplished by Right-clicking on the cell to display the “Make/Exclude” window and highlights the cell in yellow. In this instance we wish to click on “Make 2”. This establishes “2” as the cell solution.



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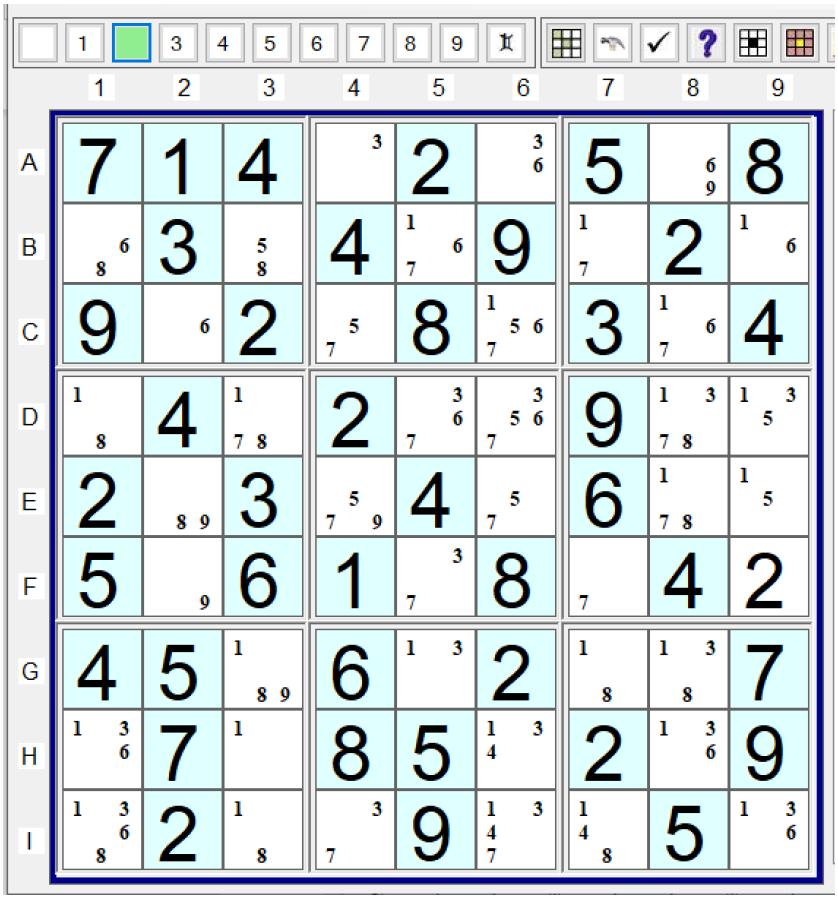
After clicking “Make 2” we see that “2” is set as the cell solution and, incidentally, the “2” Filter button is blanked since there are no more candidate cells containing “2”.



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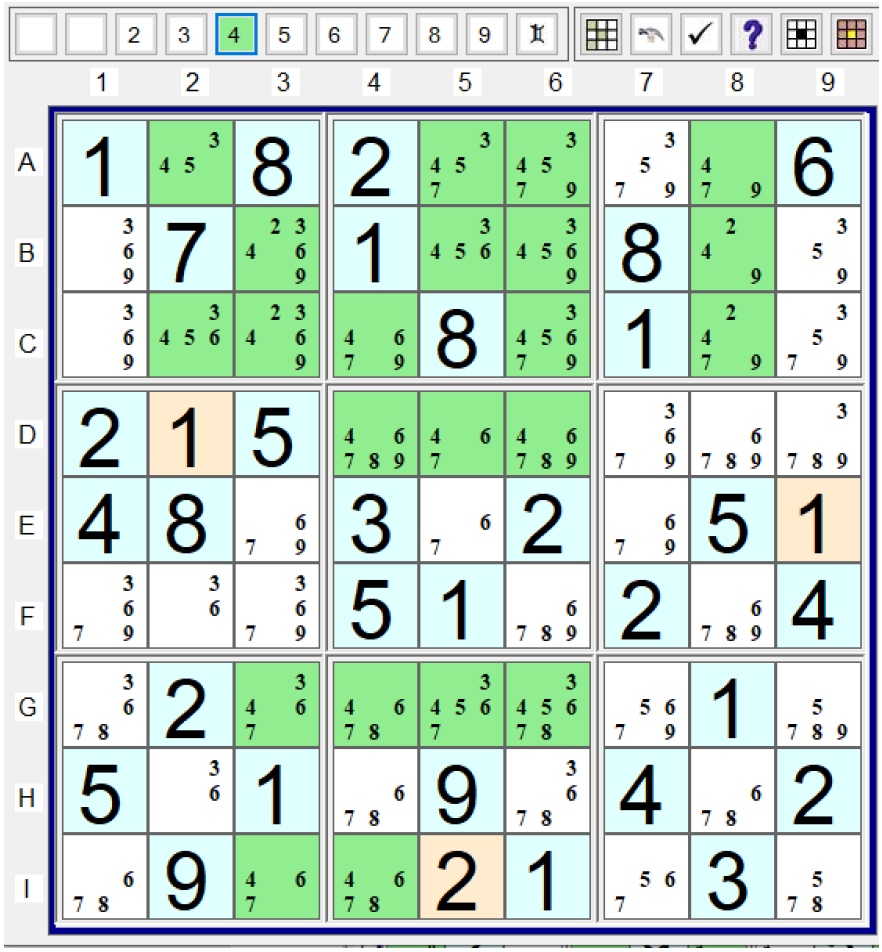
Another instance where Filtering is useful is when we see two or three cells in a box in a row or column where there a no other instances in the box. This can be seen as the highlighted cells G3 & I3 contain the candidate “4”. Since, as defined be Sudoku rules, there can only be one instance of “4” in that column, the “4”s in boxes B3 & C3 can be excluded using the Make/Exclude function.



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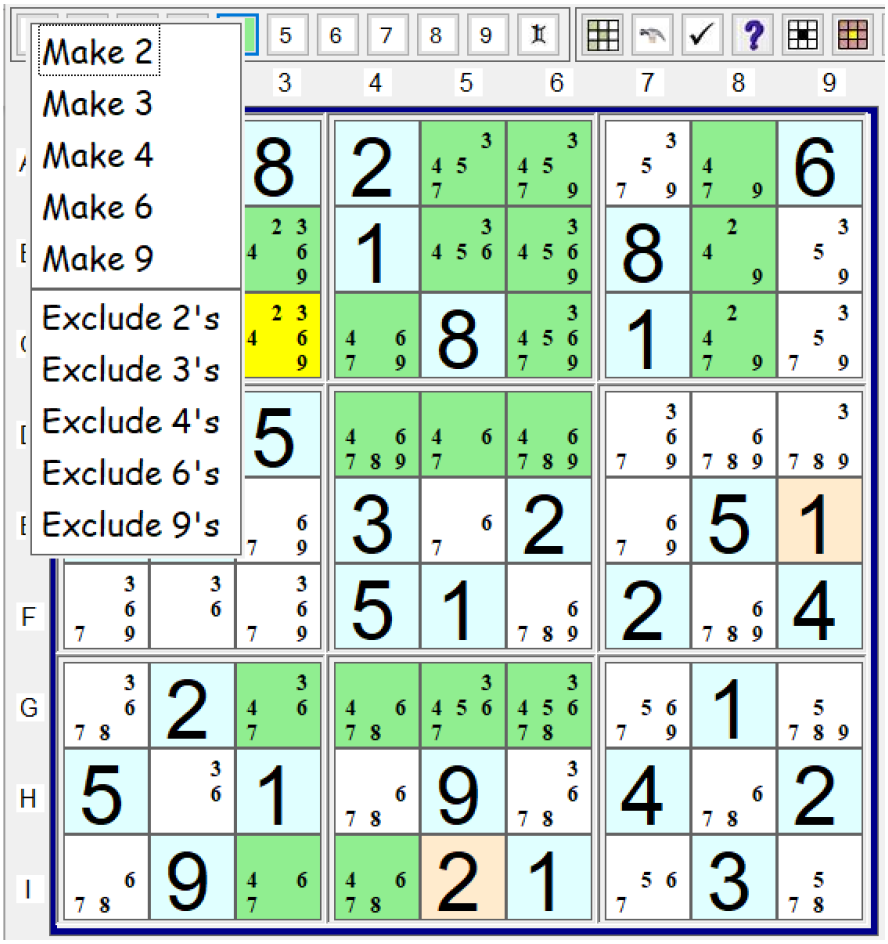

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Which leaves the following:

Notice that there are now two “4”s in A2 & C2 but there are no other “4”s in that column. Also, D4, D5 & D6 describe a “4”s row-excluder and A8, B8 & C8 describe a “4”s column-excluder, but there are no other “4”s to be excluded by either.

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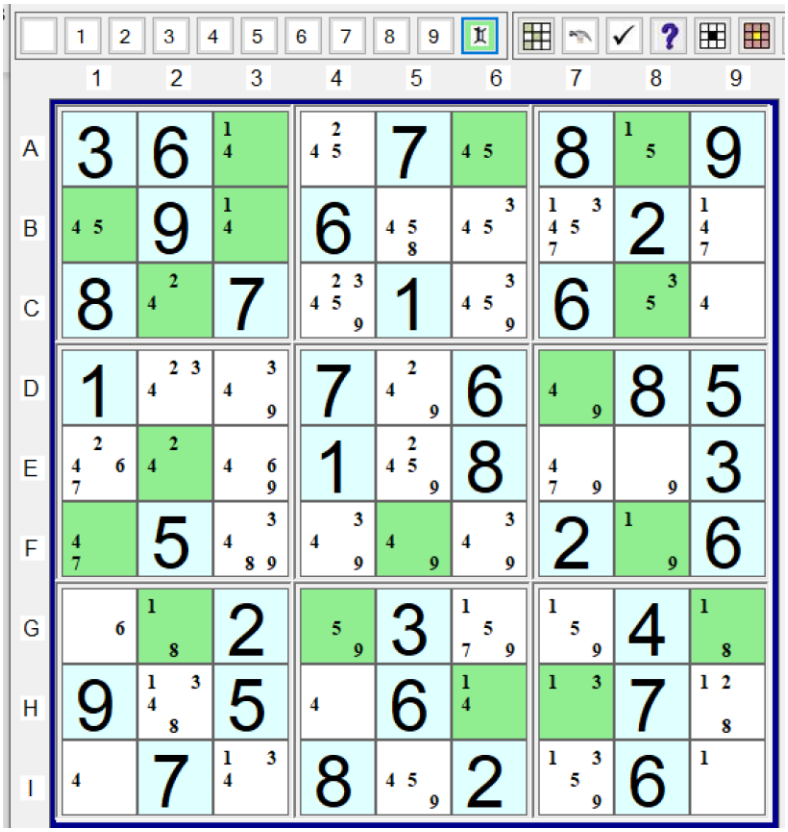
The Pairs button highlights the cells with only two candidate numbers. As you can see below, this becomes useful when two of the pairs are the same, like A3 and B3 (1,4). This means that either number in any other cell in the box, like B1 (4) and C2 (4), can be excluded using the Make/Exclude function. Also, any other instances of 1 or 4 in column 3 can be excluded: D3 (4), E3 (4), F3 (4), I3 (1,4). The instances of pairs don't have to be in the same box to be useful. C2 and E2 both have (2,4). Since they're both in column 2, any other instances in column 2 can be excluded: D2 (2,4), H2 (4).



Clicking the Clear Filters button does just that. It returns the marked cells to their normal color.

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Action Panel

The Action Panel consists of 8 buttons:

Generate Puzzle Clicking this button generates a new puzzle of the selected Difficulty

Select Puzzle Difficulty This button displays a child display where one of the difficulties can be chosen: Easy, Medium, Hard or Extreme.

Check Completed Puzzle This will cause the displayed puzzle to be checked for duplicate numbers in Rows, Columns or Boxes

Show Next Step This will show a random cell solution from the currently displayed puzzle solution in the Status text box.

Solve Naked Singles Initiates successive solving for Naked Singles throughout the puzzle.

Solve Hidden Singles Initiates successive solving for Hidden Singles throughout the puzzle.

Solve Using Dancing Links Method Attempts to solve the puzzle using the Dancing Links Method.

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Solve Using Advanced Techniques: Initiates successive solving using Hidden Single, Naked Pair, Hidden Pair, Locked Candidate, Pointing Tuple, Naked Triple, Hidden Triple, XWing, Swordfish, YWing, XYZWing, Naked Quadruple, Hidden Quadruple, Jellyfish, Unique Rectangle, Hidden Rectangle and Avoidable Rectangle techniques and show the results in the Advanced Solving Methods display.

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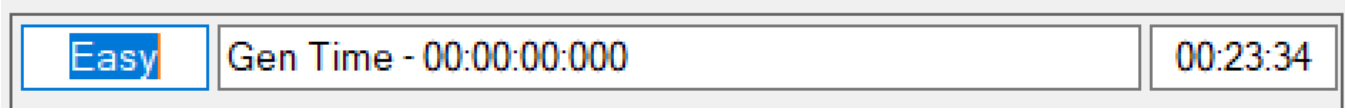
Status Panel



The Status Panel consists of the Difficulty Text Box, the Status Text Box and Timer Text Box. The Difficulty Text Box displays the currently selected Difficulty level which is used when generating new puzzles. The Status Text Box shows various status messages, also the next step from the Show Next Steps selection. The Timer Text Box shows the passing time when the timer is running.

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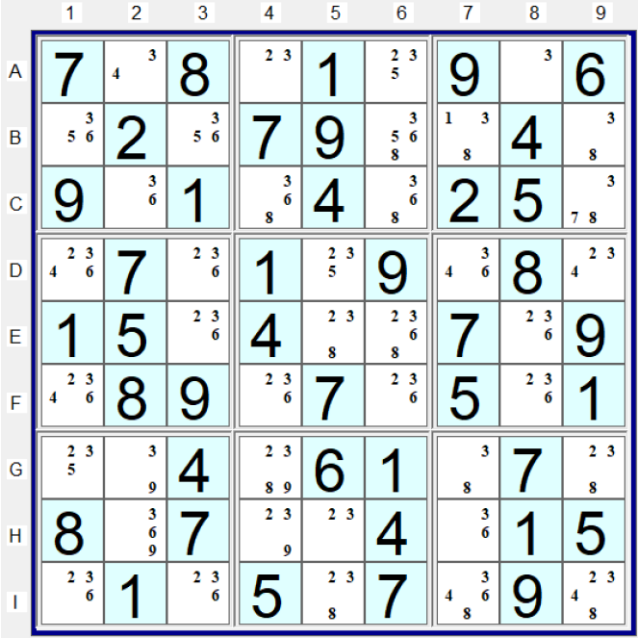
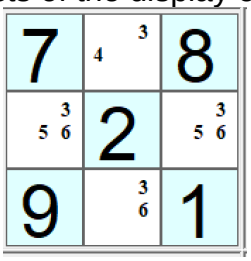
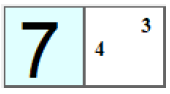
Main Panel



The Main Panel consists of the display of the current puzzle in play. It consists of 9 boxes which contain 9 cells.



Each cell contains either a solution or eligible candidates.



It may also contain blank cells while entering a new puzzle by hand.

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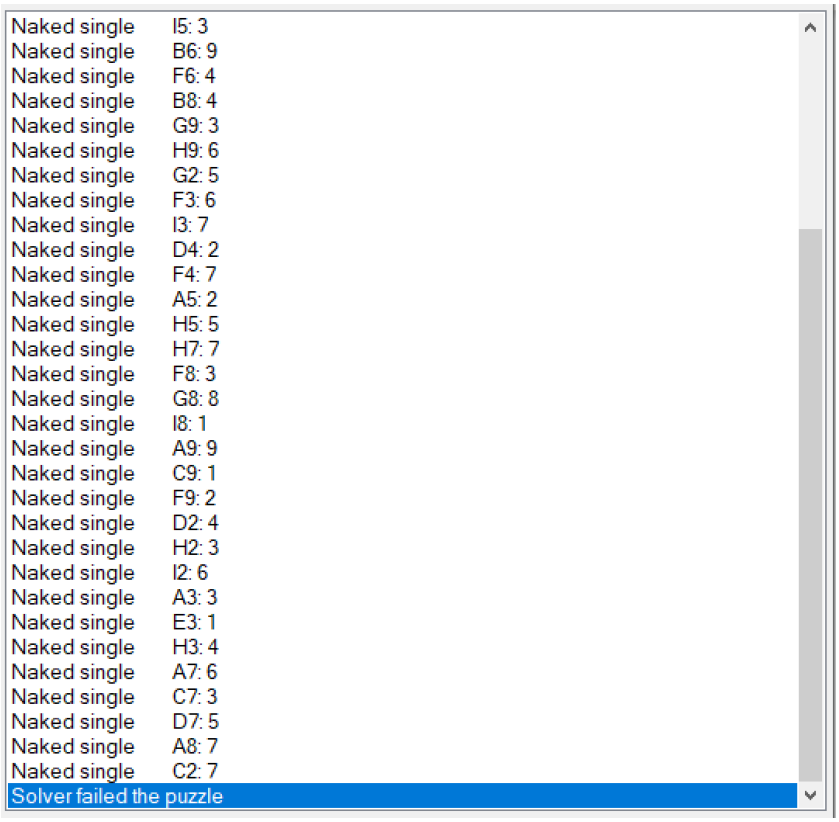
Advanced Solving Methods



When clicking the *Advanced Solving Methods* button on the Action Panel or via the **Actions** menu item, the Kermalis implementation of Advanced Solving Methods are invoked Including Hidden Single, Naked Pair, Hidden Pair, Locked Candidate, Pointing Tuple, Naked Triple, Hidden Triple, XWing, Swordfish, YWing, XYZWing, Naked Quadruple, Hidden Quadruple, Jellyfish, Unique Rectangle, Hidden Rectangle and Avoidable Rectangle and the results are shown in the Advanced Solving Methods display. Although they are displayed in the list, the solutions are not displayed in the puzzle. This is meant more as a learning tool than a way of testing whether the puzzle can be solved. For a solution display, try **Actions**->**Solve Puzzle**->**Backtracking** or **Actions**->**See Answers.**

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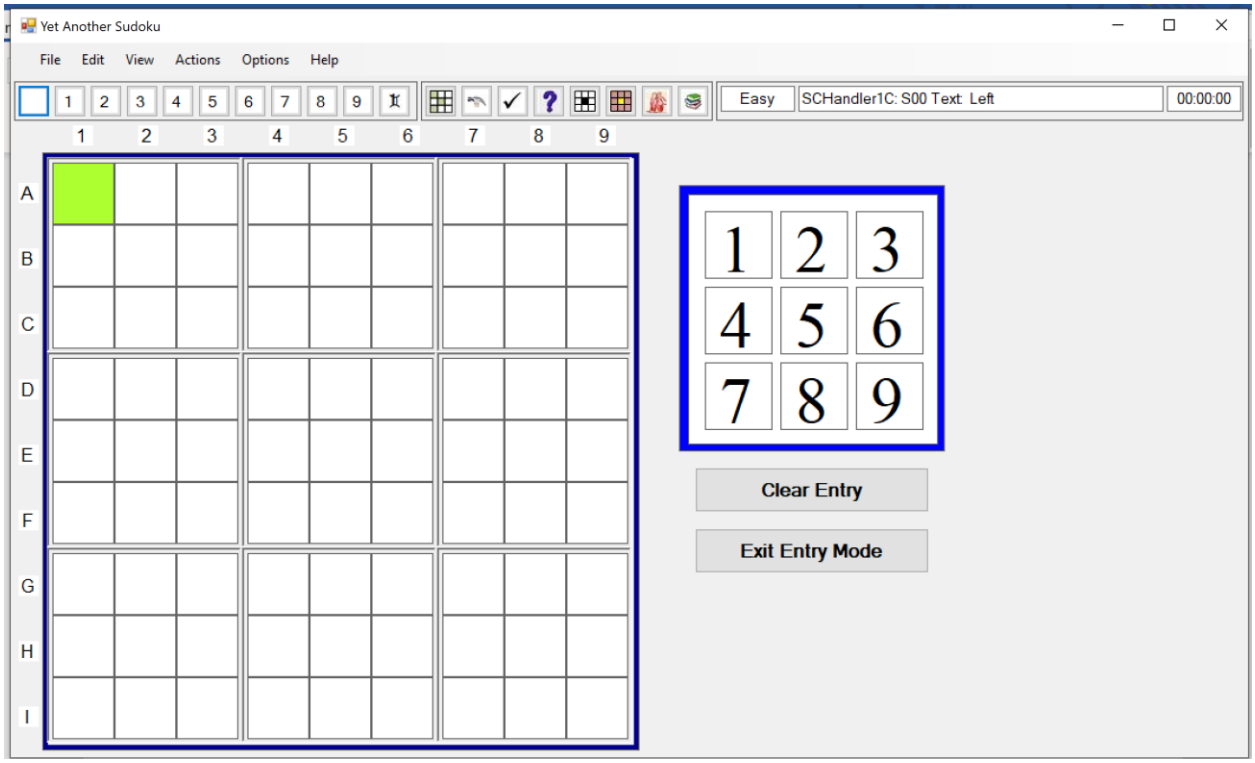
Edit Blank Puzzle



Selecting the **Edit**->**Edit Blank Puzzle** menu item, the user is presented with a blank puzzle display with the Number Entry Panel to the right. A cell can be selected for entry by either Left-clicking or maneuvering with the keyboard direction buttons. When a cell is selected, a number may be entered by either clicking on the numeric display pad or by using the keyboard number keys. The last number selected will be retained when a new cell is selected or when the process is ended via the “Exit Entry Mode” button. Using the “Clear Entry” button will clear the entry of a selected cell.

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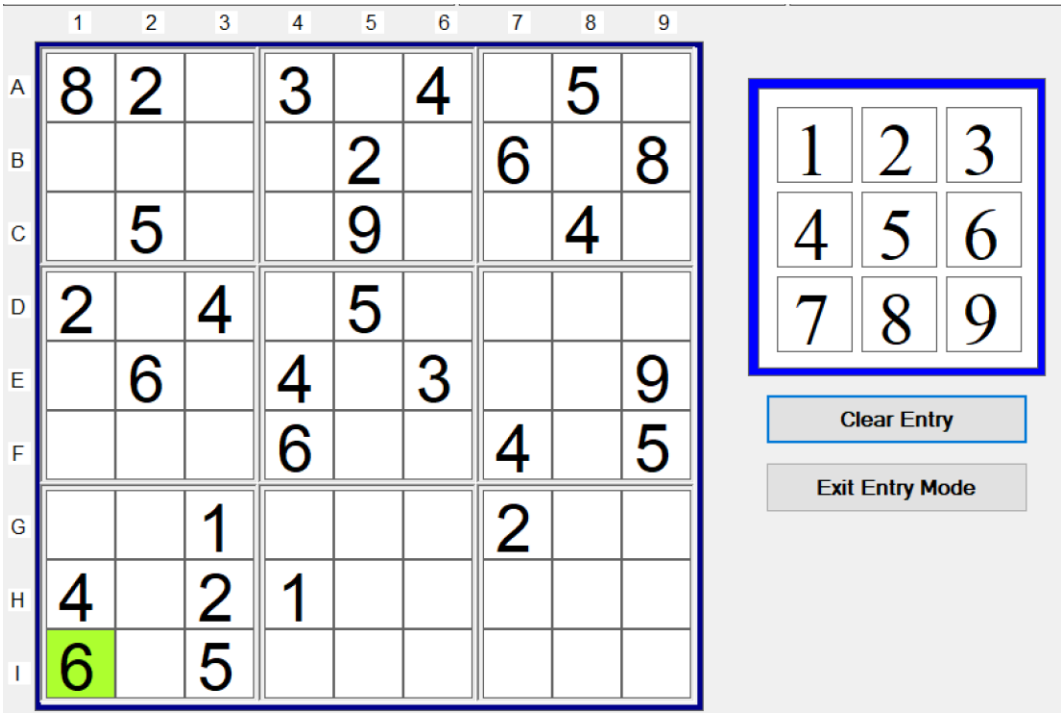
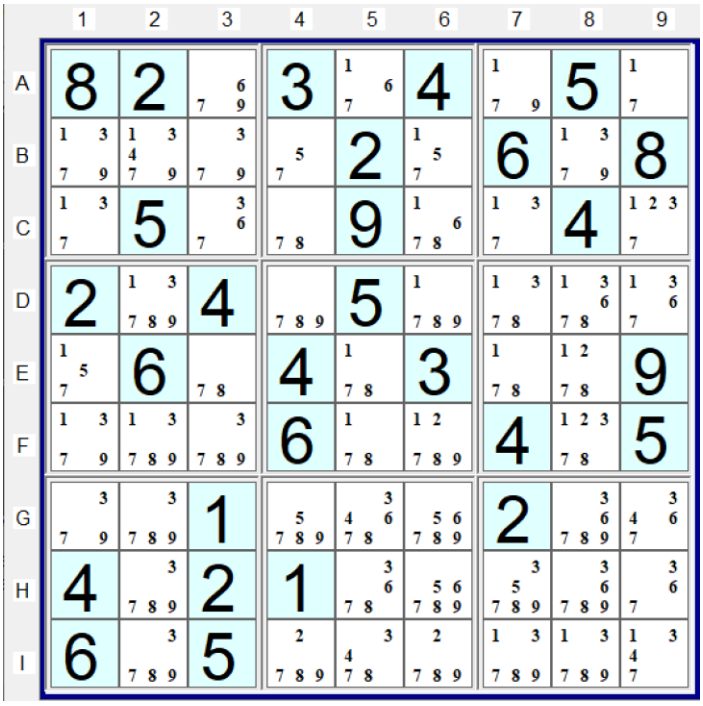


Here you see the puzzle solution values entered and by clicking on the “Exit Entry Mode” button you see the puzzle with the candidates added, ready to be solved



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Selecting the **Edit**->**Edit Current Puzzle** menu item, the user is presented with the current puzzle display without the candidates, with the Number Entry Panel to the right. Editing can be performed as was done using the **Edit Blank Puzzle** option.

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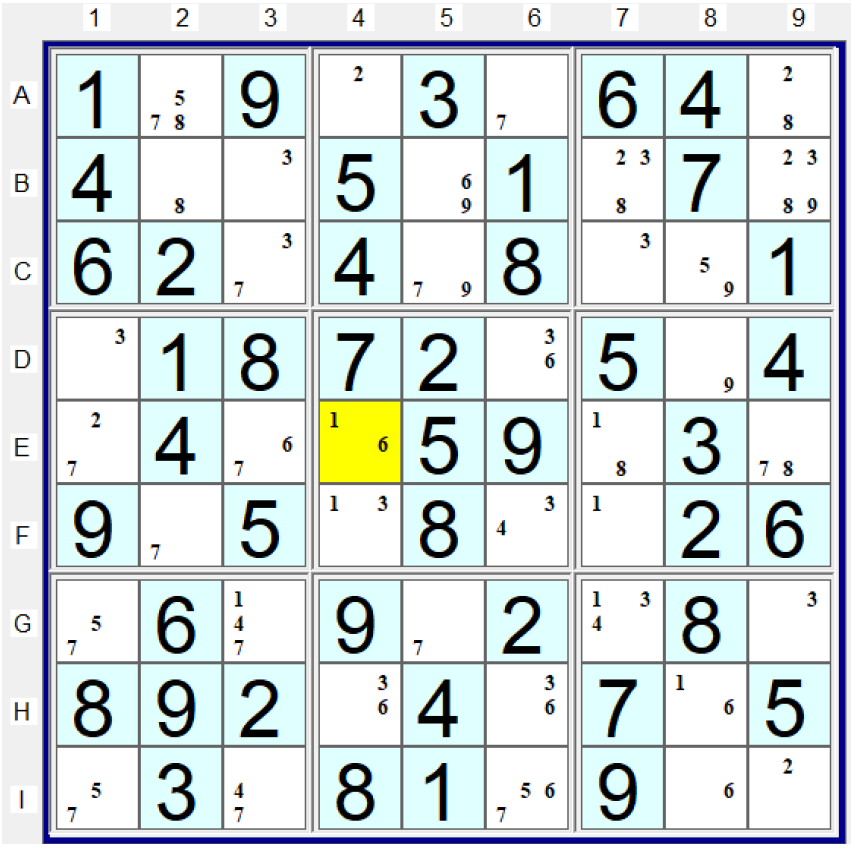
Marker Menu Selections

- **Green Marker**: Changes the background color of last-selected cell's box, row and column to Green.
- **Pink Marker**: Changes the background color of last-selected cell's box, row and column to Pink.
- **Blue Marker**: Changes the background color of last-selected cell's box, row and column to Blue.
- **Amber Marker**: Changes the background color of last-selected cell's box, row and column to Amber.
- **Remove Marker**: Resets the background color of the last marked box, row and column to its previous setting.
- **Remove All Markers**: Resets the background color of all marked boxes, rows and columns to their previous settings.

After selecting a cell as the base:



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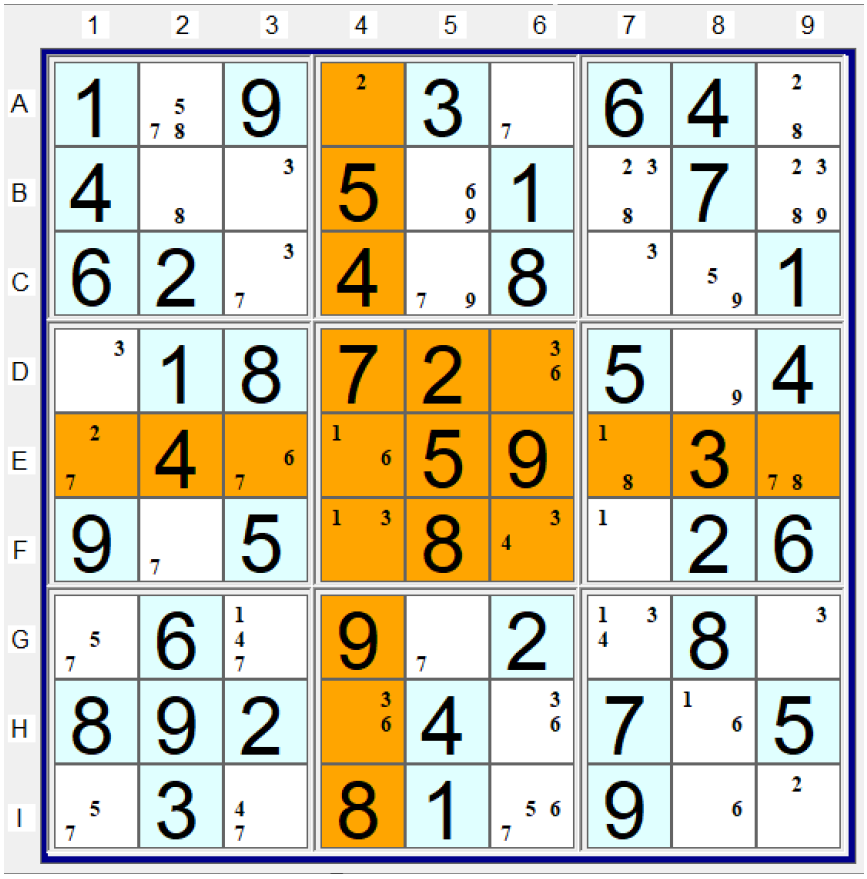
Use the **View** menu to select a Marker color. The base cell, the other cells in its box, row and column are highlighted in that color.



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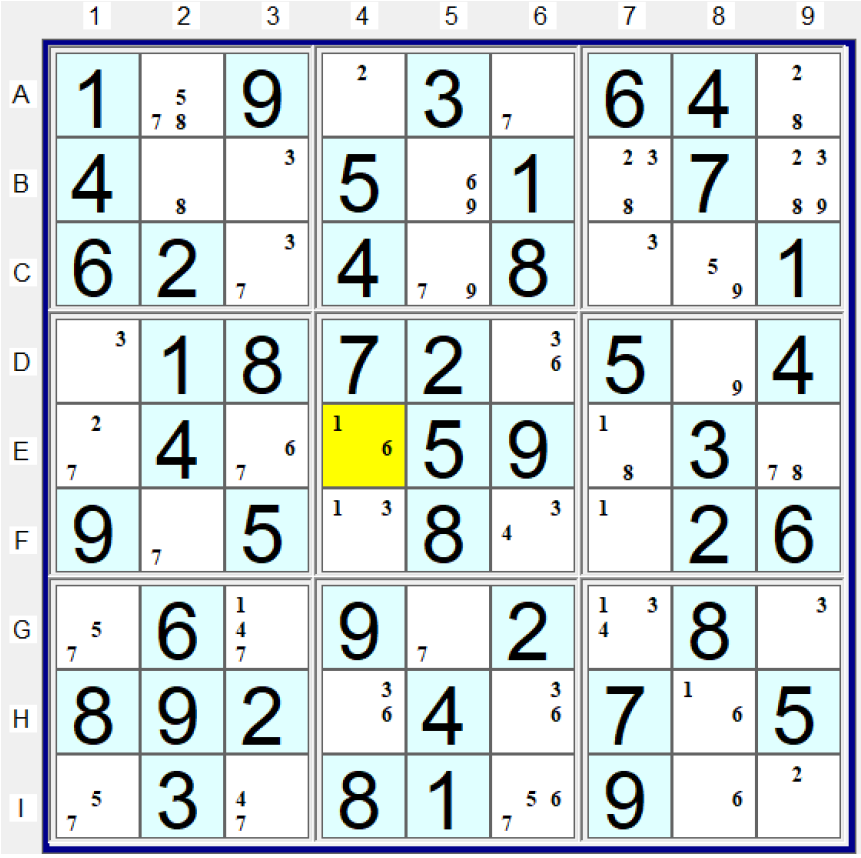
Using the View menu and selecting **Remove Marker** will replace the last Marker with the original cell colors. Selecting **Remove All Markers** will replace all the Markers.



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Errors and End Game

You've generated or loaded a puzzle and you're roaring through it, applying all those arcane solving techniques. You Filter on "5" and see a column-excluder (D2 & F2) and Right-click cell G2 to Exclude the "5" but click on the "Make 5" by mistake. The cell gets filled in with "5" but the cell also turns Pink.

Or you get down to the last four cells and they're all the same.

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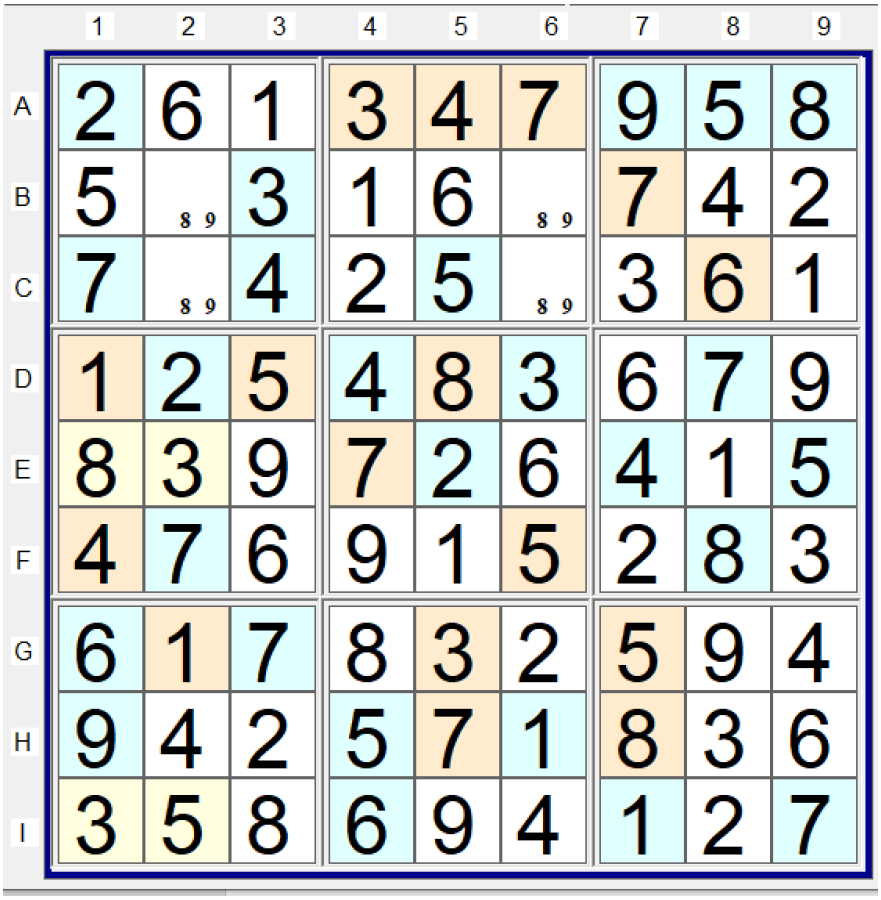

	1	2	3	4	5	6	7	8	9
A	2	6	1	3	4	7	9	5	8
B	5	8 9	3	1	6	8 9	7	4	2
C	7	8 9	4	2	5	8 9	3	6	1
D	1	2	5	4	8	3	6	7	9
E	8	3	9	7	2	6	4	1	5
F	4	7	6	9	1	5	2	8	3
G	6	1	7	8	3	2	5	9	4
H	9	4	2	5	7	1	8	3	6
I	3	5	8	6	9	4	1	2	7

Do you click on the Question Mark button for a ‘Hint” or do you just take a guess? You decide to take an educated guess. You might as well. You’ve got a 50-50 chance of getting it right, and, invariably, you guess wrong. The cell is filled in with the chosen number but the cell color changes to Pink.

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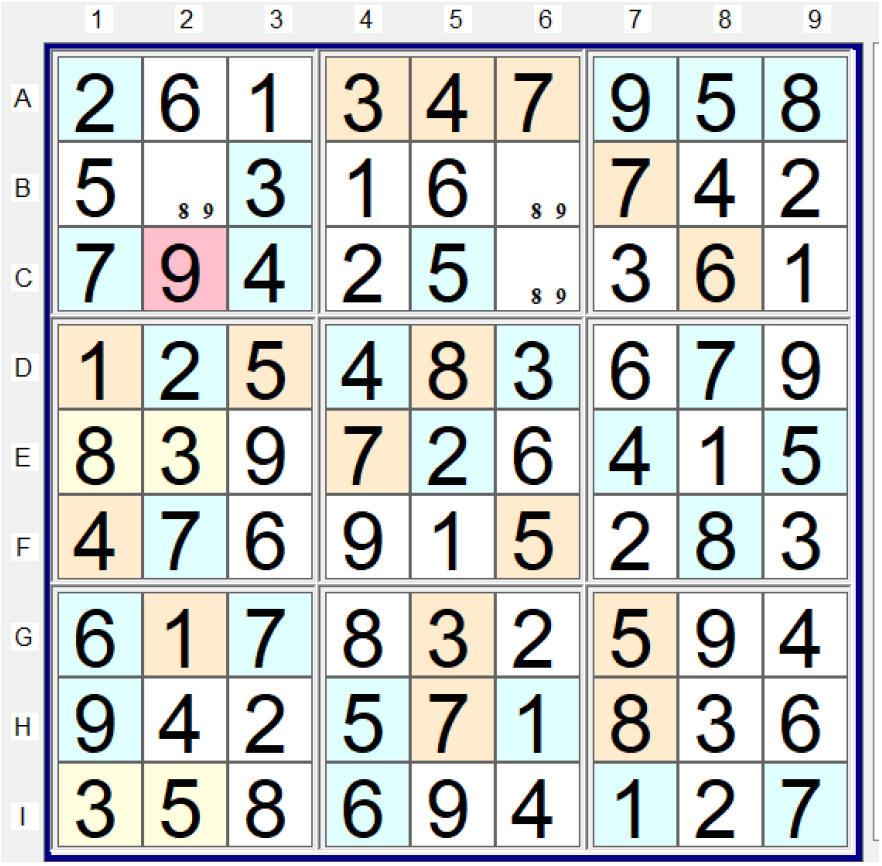

Oh, the horror of it! Must you have your donkey led through the town with you sitting on it backwards wearing a dunce cap?? Well, you can if that's your thing, but if you just Left-click on the cell, the contents will be reset as will the cell color, allowing you to try a different solution.

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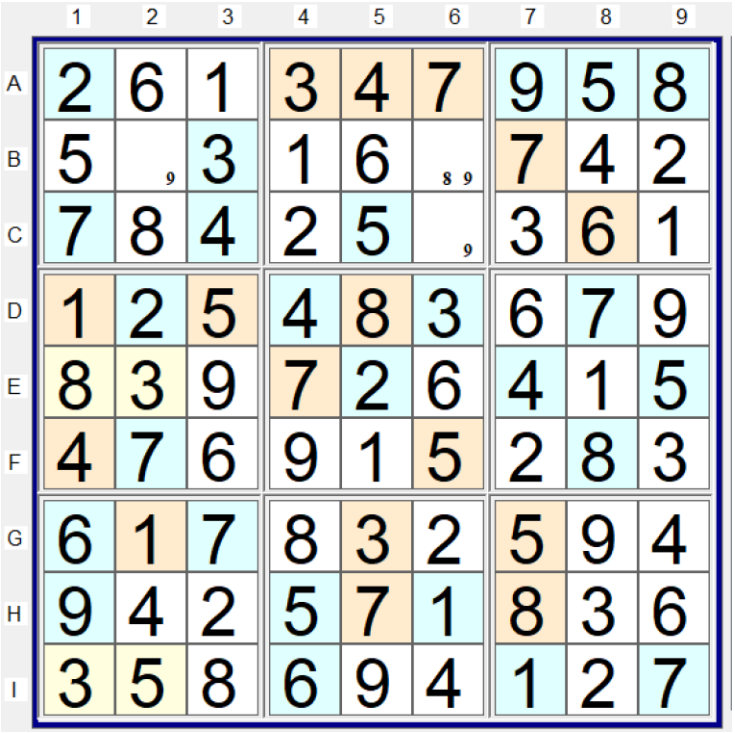
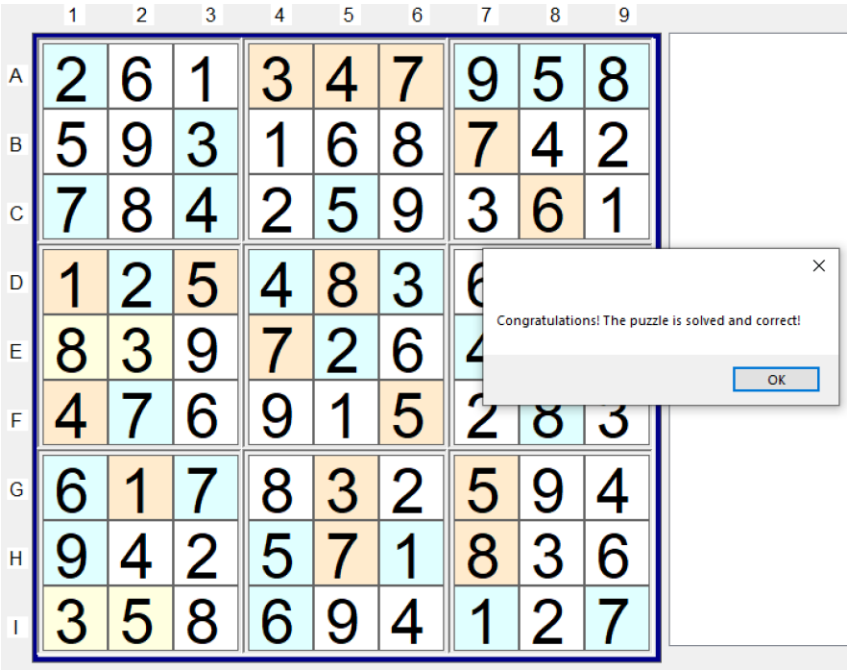


	1	2	3	4	5	6	7	8	9
A	2	6	1	3	4	7	9	5	8
B	5	9	3	1	6	8 9	7	4	2
C	7	8	4	2	5	9	3	6	1
D	1	2	5	4	8	3	6	7	9
E	8	3	9	7	2	6	4	1	5
F	4	7	6	9	1	5	2	8	3
G	6	1	7	8	3	2	5	9	4
H	9	4	2	5	7	1	8	3	6
I	3	5	8	6	9	4	1	2	7

Then clicking the “Solve Naked Singles” button will, invariably, finish solving the puzzle with no ass-riding involved.



	1	2	3	4	5	6	7	8	9
A	2	6	1	3	4	7	9	5	8
B	5	9	3	1	6	8	7	4	2
C	7	8	4	2	5	9	3	6	1
D	1	2	5	4	8	3	6	7	9
E	8	3	9	7	2	6	4	1	5
F	4	7	6	9	1	5	2	8	3
G	6	1	7	8	3	2	5	9	4
H	9	4	2	5	7	1	8	3	6
I	3	5	8	6	9	4	1	2	7

Have Fun!