

# Sudoku Solver

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CP212

29 July 2019

The following program attempts to solve any given sudoku problem. To accomplish this an algorithm utilizing the AC-3 method where arc-consistency is enforced in accordance with the rules of Sudoku. Each sudoku board is constrained to a limited list of possible states. A typical Sudoku puzzle contains a 9x9 grid of which there are 81 possible variables. An initial placement of values create the starting constraints. Values range from 1-9. Each given Sudoku puzzle is modeled as the following.

$$\begin{array}{l} X = S_{00}, S_{01}, S_{02} \dots S_{08} \\ \quad S_{10}, S_{11}, S_{12} \dots S_{18} \\ \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ \quad S_{80}, S_{81}, S_{82} \dots S_{88} \end{array}$$

$$D = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9 \} = \text{Possible values}$$

$C$  = All rows and columns must not have a repeating value respectively. All 3x3 blocks must also not hold a repeating value.

The program utilizes VBA and Excel. There is an option to load a Sudoku puzzle from a database if desired. Sudoku puzzles must be in the following format as a string:

046379502  
780006100  
035000647  
200730060  
400692700  
001005009  
007060951  
509123000  
804007030

0's functionally act as an empty space. The AC-3 algorithm will subsequently remove values from the total list of possible values (the domain values) until the constraints are satisfied. A remaining domain value is then selected to take the 0's space. This process is repeated until the puzzle is solved. It is possible for the algorithm to back itself into a corner, thus creating a dead end scenario.

The program also supports reporting the results of the puzzle into a word document.

The above puzzle once attempted by the algorithm resulted in the following output:

146|379|582

782|546|193

935|218|647

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298|731|465

453|692|718

671|485|329

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327|864|951

569|123|874

814|957|236