

Sudoku Solver Manual

Version 1.3

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Part

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1 Introduction

1.1 Sudoku Solver

Welcome to the Sudoku solver, a free utility provided by DeadMan's Handle Ltd as an aid to Sudoku puzzle solvers everywhere. The program is straightforward to run, and will solve any puzzle almost instantaneously. It also allows you to save and load puzzles and solutions, and eMail them to recipients.

We hope you enjoy the program, and please [contact us](#) should you need any further help at any time.

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1.2 Installation

If you have opted for the full installation program, then simply run the install program SudokuInstaller.exe. You will be prompted through the installation process. This installation method requires that you have the Windows Installer on the system. Note that you can use the 'Add or Remove Programs' utility to remove the Sudoku Solver if you use this installation mechanism.

You can also download the distribution kit as a Zip file, SudokuInstall.Zip. Simply copy the files to a folder and create any required icons on the desktop or start menu. To remove the program, simply delete the folder and any icons that you have created.

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2 Using the Solver

2.1 The Solver Screen

When you start up the Sudoku Solver, you will be presented with the following screen:



Beneath the title are the following items:

1. The [menus](#).
2. The quick [speed buttons](#), that reproduce all important menu items for quick access.
3. The Sudoku [entry and results](#) grid.
4. A progress bar at the bottom left.
5. To the right of the progress bar, a blank space where the system will give status messages.

The last two items are read-only: they simply provide information on how quickly the puzzle is being solved and give you information when certain activities are complete. It should be noted that on modern machines the progress bar is effectively redundant unless you are in training mode: the solution will be provided almost immediately.

You will use this form to enter the puzzles, and get the solutions. The form also allows you to save and load puzzles, and send them as eMails.

2.2 The Menu and Buttons

This section describes the use of the menus. Each menu entry will be discussed with its equivalent button (except in the cases where there are no equivalents). All menus have accelerator keys, indicated by the underlined letter: hitting the Alt key plus the letter will activate the menu item (so to load a puzzle one hits Alt-F then Alt-L). If you cannot see the underlined keys under Windows XP or 2000, check that you have not hidden the underlined keys (an option under the display settings). In addition, all submenu items have an associated function key: pressing the function key will activate the menu item directly.

The File Menu

There are four submenu items under the file menu. Each one will be discussed in turn, along with

the different ways of accessing it. The equivalent speed button is shown alongside the submenu title, which is shown in the style Menu->Submenu.

File->New

This will clear down the grid and reset the system to the blank state (see the discussion about the entry and results [grid](#)). All displayed values will be 0. The progress bar and status indicator will be cleared as well. This should always be done before a new puzzle is entered or loaded.

This may be accessed by hitting Alt-F then Alt-N, or by pressing the F1 key.

File->Load Puzzle

This will load a puzzle (or a completed result) which has been previously saved using the Save Screen option. The files must be in the correct text format. The system will load and display the puzzle.

The menu entry may also be accessed by Alt-F then Alt-L, or by pressing F2.

File->Save Screen

This will save a puzzle or completed result, which can then be reloaded using the Load Puzzle option. The numbers you see in the [grid](#) when the option is selected is what is saved out to the file. The file is actually just a text file with the numbers simply arranged in a 9 by 9 array representing the Sudoku grid. You can mail this file (see also the [mail options](#)) or incorporate it into a document.

The option may be accessed via Alt-F then Alt-S, or by pressing F3.

File->Exit

This simply exits the Sudoku Solver program.

This may also be accessed via Alt-F then Alt-E, or by using F4.

The Run Menu

This has just two submenus: Go and Training.

Run->Go

This will take the current grid, and solve it, if it is possible to do so. The system will tell you if the grid entries are illegal (such as the same number in a row or column). If the puzzle is ambiguous, then the system will produce the first solution it comes to. See the [discussion](#) for further comments on Sudoku solutions.


This option may be accessed by Alt-R then Alt-G, or by pressing F5.

Run->Training

This turns on the training mode. This special mode activates the Step button, and allows you to see the progress of the solution. The Step button is shown below. The way to use training is as follows:

1. Load or enter the puzzle.
2. Activate training by clicking on the Training button. You will see the Step button (green arrow) become active, and the Exit button will become disabled. Note that you cannot exit whilst training mode is enabled.
3. Press the Run button (red arrow). Some numbers will appear in the grid. Press the Step button, and some more numbers will appear. You can step through the entire puzzle, until

- 'Done!' shows as the status message.
4. Training mode is automatically disabled when the puzzle is completed.

The Step button looks as so: 

The training mode is limited; please see the [discussion](#) for details.

The training mode option may be accessed by Alt-R then Alt-T, or by pressing F11.

The Mail Menu

There are three items in this menu. These provide eMail support, allowing you quickly to send off solutions (or even puzzles) to friends or magazines (especially in the latter case, where there may be prizes involved).



Mail->Set up eMail

This gives you access to the [eMail Template System](#). This allows you to set up your templates for eMailing puzzles and solutions.

This may be accessed by Alt-M then Alt-U, or by pressing F6.



Mail->Send eMail

This option will take all your eMail template information, and the header information in the header section, and adds the puzzle or solution that is being displayed in the grid. It then mails it using its own SMTP client to the recipient(s) nominated in the header. Please note that you must be connected to the SMTP server (usually either by dial-up or some form of DSL) before selecting this option as it will time out after 15 seconds.

You can access this with Alt-M then Alt-N, or by using F7.



Mail->Save eMail Text

This will combine your eMail template information with the grid information to produce a completed text message, which can be saved as a file. This is provided for people who are not using an SMTP mail system: the text can quickly be pulled into a mail and sent off.

This can be accessed with Alt-M and then Alt-V, or by using F8.

The Help Menu

This just provides two options, which allow access to helpful information.



Help->Help

Calls up this help file.

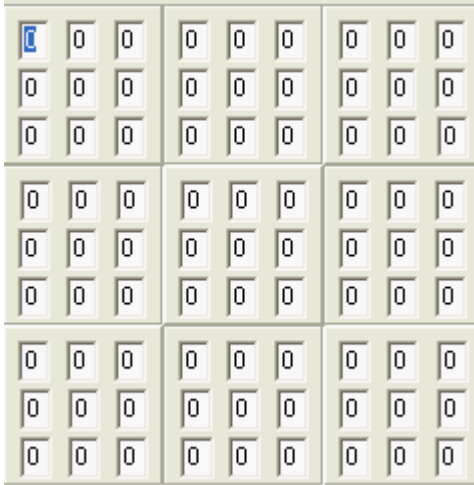
This can be accessed with Alt-H and Alt-H, or by pressing F9.

Help->About

This just shows a box with some basic program details. This menu option does not have a speed button.

2.3 The Entry and Results Grid

The grid is the middle part of the solver screen, which looks as follows:



It basically represents the standard Sudoku grid. A zero in a cell means that there is nothing in it: it is the same as a blank. The system is set up so that you cannot enter anything except a numeric digit into the cells.

When you are entering the puzzle, you can enter the data in two ways:

1. You can move from cell to cell using the Tab key. When you arrive in a cell you will find the digit highlighted. Simply type the digit you want, and then tab on to the next field. If you tab straight through the digit in the cell will remain unaltered. Shift-Tab will move you backwards through the cells.
2. You can highlight any digit using the mouse and right-click button, and then type in a new digit.

When you have entered a puzzle, you can then save it, using the [save](#) option. This will save the grid as you see it. Thus the usual way to use these options is to enter the puzzle, save it, solve it by running the solution process, and then save the result. You can also save intermediate results between steps in the training mode.

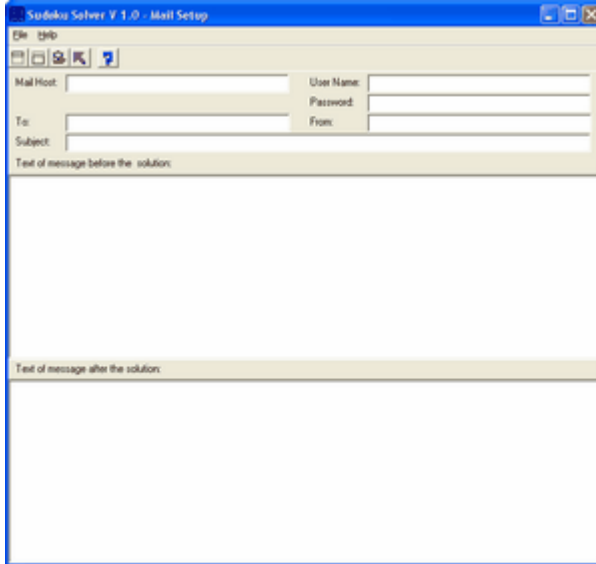
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3 The eMail Template System

3.1 The eMail Template Screen

When you select the [Mail->Set up eMail](#) menu option on the solver screen, you will be taken to the eMail template form. This looks as follows:



This screen is made up of the following:

1. There is a menu.
2. Below this, there is a group of quick access speed buttons.
3. There is a header section, which has six fields.
4. There is a text section.
5. There is then a second text section.

The [menu and buttons](#) are discussed elsewhere; here we discuss the fields. These all act as templates for your puzzle solution messages.

The eMail Header Section

This comprises six fields:

1. The first is the Mail Host name (or IP address). This will usually be something like smtp.hostname.com or smtp.hostname.co.uk. This field must be filled in, as it is how the eMail gets sent to the host.
2. The second field is the user name field, and the third is the password. These fields are optional: they are only needed when your SMTP server requires authorization. Most do not.
3. The fourth field is the To: field. You must enter the full mail address of the person (something like name@host.com). You may put in more than one mail address, separating them with commas.
4. The fifth field is the From: address. You should put in your mail address here.
5. The sixth and last field is the Subject field: what the recipient will see as the mail subject.

The Text Sections

There are two text sections. One will be placed before the grid information, and the other after the grid information. The idea is that you can have a brief introduction, then the puzzle answer, and then your signature. This is especially designed for competitions.

How it all Works

All the information you put into the sections is saved in template files. You then do not have to update them unless you want to: the system is designed for a regular competition that you might be entering. You can then do a puzzle, and eMail it just by hitting the [Send eMail](#) button. The information will be taken from the templates and the grid, which is holding the solution, and will be sent off via the SMTP client. Alternatively, you can just [generate](#) the text message and then pull it into another mail client and send it. In this latter case no part of the header template is used in the text message.

The system is designed to be quick to use. Having set up the templates for a regular competition, you can just enter the [Sudoku puzzle](#), [run](#) the solution process and then [eMail](#) the answer to the predefined address.

3.2 The Menu and Buttons

The template screen has a few menus and buttons. In all but one case the menu entries have a matching speed button and quick access methods.

The File Menu

The file menu has four options, described in this section.

File->New Header

This will clear down the top six header fields, from Mail Host to Subject. This is for when you want to set up a new template. Note that the system will only maintain one template at a time.

You may also access this with Alt-F and Alt-H, or by pressing F11.

File->New Text

This will clear down the bottom two text fields. Again, this is for when you want to set up new text in the template.

You may also access this with Alt-F and Alt-T, or by pressing F12.

File->Save

This will save all updated information to the templates. Note that you will not be asked for a file name: the templates are special files that the system keeps track of.

You can access this option with Alt-F and Alt-S, or with F3.

File->Return

This will return you to the [solver screen](#). If you have changed any of the information in the fields you will be asked if you wish to discard the changes.

You can access this option with Alt-F and Alt-R, or with F4.

The Help Menu

This just provides two options, which allow access to helpful information in exactly the same way as in the solver screen.

Help->Help

Calls up this help file.

This can be accessed with Alt-H and Alt-H, or by pressing F9.

Help->About

This just shows a box with some basic program details. Note that this is the only menu option on this form that does not have a speed button.

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4 Discussions

4.1 Sudoku Solutions

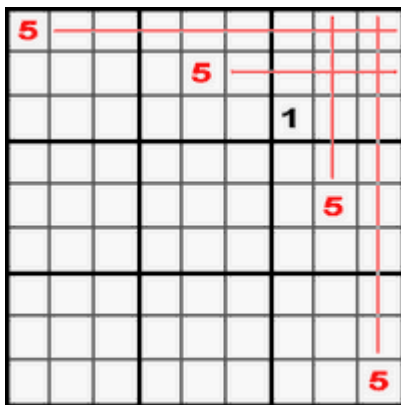
This topic briefly discusses how the DeadMan's Handle Sudoku Solver functions.

When you input a puzzle, the system first scans it to ensure there are no obvious errors (such as two numbers the same in a row, column or 3x3 box). It will generate a message if there are.

The system will then attempt to solve the puzzle deterministically. For most puzzles this will yield the solution. For some puzzles the deterministic capability produces no further progress, either because the puzzle has more than one solution or because it is very subtle. At this point the system does a structured exploration of solutions, looking for inconsistencies until the solution is found.

If a solution is possible, then the system will find it almost instantaneously on a modern machine (unless in training mode). If there is more than one solution possible, then the system will return the first solution it finds (as an experiment, run the solver with all zeros in the grid).

If a solution is not possible, then the system will determine that it cannot find a solution. It will return a partially completed grid which will still have some zeros in it, and will generate a warning message. Note that it is possible for the system's initial checks not to be able to identify a problem with a puzzle: it only appears in the solution attempt. As an example, consider the following partial fragment of a problem (this is an artificial example):



Because of the row and column rules, with the positioning of the fives and the one, there is no possible place for a five in the top-right 3x3 box, which is impossible according to the relevant Sudoku rule. However, there is nothing in the positioning of the fives and ones that is obviously contradictory (ie no two fives are in the same row). It is in such cases that the system will come back with an incomplete grid and a warning message.

4.2 Training Mode

The training mode is a mode where you can see the solution being produced in steps. However, Version 1.3 should be regarded as an evolutionary stage for the training mode - it will be improved.

Once you have activated the training mode you still have to start the solution by pressing Run (the red arrow). The solution will then advance in stages as you press the Step button (green arrow). It is important to note the following:

1. As you step through, more than one number may be added to the solution grid. Currently, each 'step' covers one cycle of Sudoku Solver's application of rules; however, each cycle may fix more than one number.
2. Stepping only works while Sudoku Solver is in 'deterministic' mode: when it is able to exactly

calculate missing numbers. In certain puzzles Sudoku Solver has to start guessing (what we call 'hunt' mode) - at this point it will run through to completion, as tracking what is going on in hunt mode can become very confusing.

3. You should step through until you see the 'Done!' indicator.
4. Training mode is always turned off again once a puzzle has been solved.

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5 Licences

5.1 Sudoku Solver Licence

The following is the licence for the Sudoku Solver.

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5.2 Indy Components Licence

The Sudoku Solver uses the Indy components. We are required to include the following as the Indy components licensing information.

Indy BSD License

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