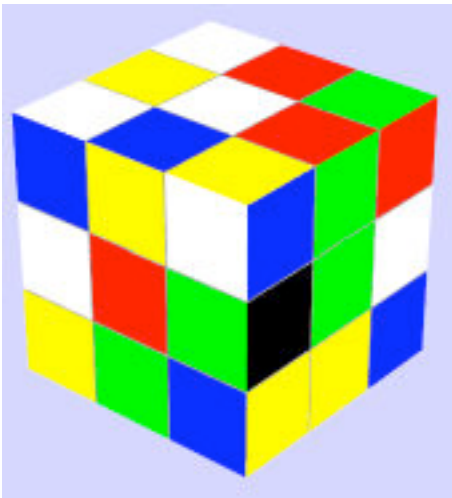


Cube Solver Docs

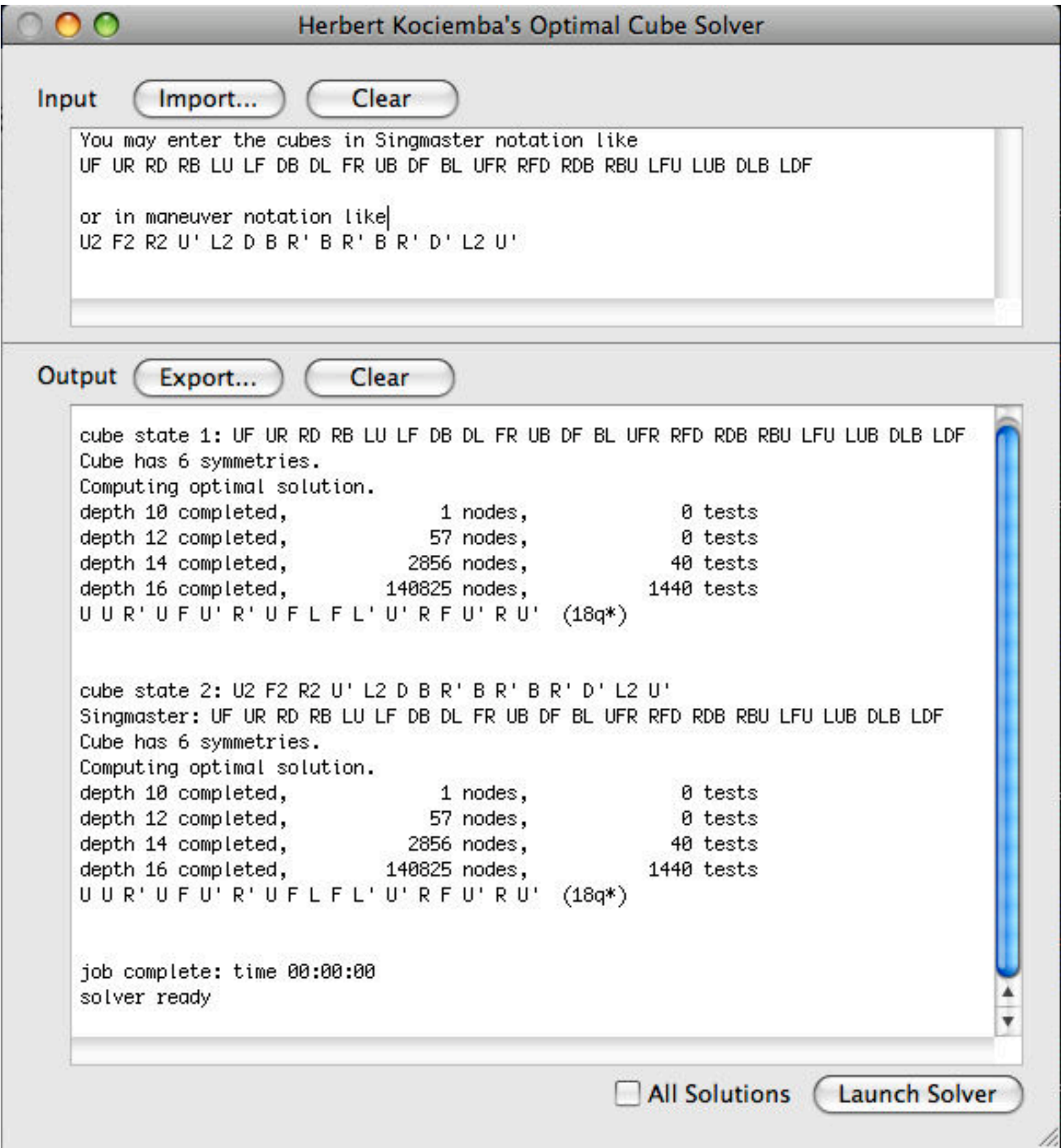
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Solver is a Mac OS implementation of Herbert Kociemba's Optimal Cube Solver, a program which finds the shortest possible solutions for states of the Rubik's Cube Puzzle. Mr. Kociemba has generously provided source code in generic C for a command line version of the program. The present implementation wraps Mr. Kociemba's code in a OS X Cocoa interface to rescue the Mac user from the trauma of dealing with the Unix terminal and its command line interface.



The User Interface

The core of the interface are the **Input** and **Output** text views. The **Input** view is fully editable and it is where the user enters the cube states to be solved. One may directly type in the states, paste from another application, drag and drop, or read them in from a text file by clicking the **Import** button. The solver accepts multiple cube states, each as a separate line, and will solve each in turn.

Once the **Input** text is set up as desired, pressing the **Launch Solver** button passes the contents of the **Input** view to the solver. As the solver works the results are printed to the **Output** view. The **Output** view is not editable. One may select text in the **Output** view for copy and paste to another application or save the **Output** view contents to a text file by pressing the **Export** button.

By default the solver stops working on a problem state once it has found an optimal solution. Checking the **All Solutions** check box causes the solver to continue working at the optimal depth and find all solutions of that length.

While the solver is working the caption of the **Launch Solver** button changes to **Stop Solver**. Pressing the **Stop Solver** button causes the solver to abort the current job and return to the ready state.

Cube State Notation

Cube states may be entered in either of two ways, both after Singmaster. First as a sequence of Rubik's cube 90⁰ face rotations which will generate the state. Second as a configuration specifying the positions and orientations of the eight corner and twelve edge cubelets of the cube.

The six faces of cube are named the Up, Down; Front, Back and Right, Left faces, abbreviated U,D,F,B,R,L. A clockwise 90⁰ rotation of a face is designated by a one letter abbreviation. U designates a clockwise rotation of the Up face. An anti-clockwise rotation is designated with a prime character. U' designates an anti-clockwise rotation of the Up face. The sense of the rotation is from a face relative perspective. That is, as viewed looking directly at the exposed side of the face. Thus, R and L turn the Right and Left faces in opposing directions. Spin the wheels of a two wheeled cart in such a manner and the cart will rotate in place. The sense of rotation is that one would use to tightened(cw) or untighten(ccw) a nut and bolt passing through the opposing faces.

The solver accepts input as a sequence of face rotations as defined above:

U2 F2 R2 U' L2 D B R' B R' B R' D' L2 U'

As the example shows, two consecutive turns of the same face may be indicated by appending a 2: U2 == U U. This works only for clockwise rotations. The equivalent U'2 is not supported. Also, parentheses are not supported. One may not use (U R')2 for the turn sequence U R' U R'.

A cube state may be entered as a configuration. The individual cubelets are designated using the same letters used for the six faces. Edge cubelets are designated using two letter codes. UF designates the cubelet lying on the edge defined by the intersection of the Up and Front faces. Corner cubelets are designated using three letter codes. UFR designates the cubelet at the point of intersection of the Up, Front and Right faces. The twelve edge and eight corner cubelets are listed in order of their present positions on the cube. The order is defined in reference to the standard designation for an unscrambled cube:

Identity Cube:

UF UR UB UL DF DR DB DL FR FL BR BL UFR URB UBL ULF DRF DFL DLB DBR

Altered State:

RU FU UB UL DF DR DB DL FR FL BR BL **URB UFR** UBL ULF DRF DFL DLB DBR

In the example above, the edge cubelet normally in the Up-Right position has been moved to the Up-Front position, oriented with its Right facelet now in the Up position. The UF cubelet is in the UR position oriented with its Front facelet in the Up position. Similarly the UFR and URB corner cubelets are swapped, each with their Up facelets maintained in the Up position.

Odds and Ends

The Pruning Table File

The first time the program is launched a 538 megabyte look-up table is created. This will take upwards of a half an hour. To avoid having to recreate this table each time, the table is saved to disk and thereafter loaded each time the program is run. The program saves the file as part of the application bundle. If the user moves the application to a different directory the table is moved along with it and the application will always be able to find it. In consequence the application file becomes huge, 538+ megabytes. This might become inconvenient if the user wishes to transmit the program via the internet or save it to external media. If this becomes the case, the table may be stripped from the bundle by control-clicking the program icon and choosing "Show Package Contents" from the resulting drop down menu. Navigate to ../Contents/Resources. Drag the file, "pruntable", out of the bundle to say the desk-top. One may now make a copy of the stripped file and then return "pruntable" to the bundle's Resources folder.

Mac OS Virtual Cubes on the Web

It is unlikely this program would be useful for anyone without a virtual Rubik's cube program to generate the input. The author is aware of several on the web.

Tom Davis's Rubik program:

<http://www.geometer.org/rubik/index.html>

Werner Randelshofer's CubeTwister:

<http://www.randelshofer.ch/cubetwister/>

And the author's effort:

Herbert Kociemba's Site

The source code for the cube solver may be downloaded from Mr. Kociemba's web site:

<http://kociemba.org/cube.htm>