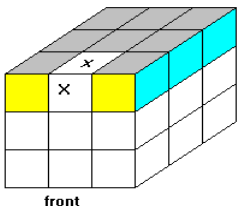# THE SEVEN*-STEP RUBIK'S CUBE® SOLUTION

by John L. Dalton

(1) Solve one layer except for one edge. For example:


where X is the unsolved edge
(it can be solved, but it doesn't have to be)

Note: see "Explanation of Symbols and Terms"

(2) Positioning corners. Our goal in this step is to put the corners in the correct position for the layer opposite the solved layer. We are not concerned about the correct orientation of the corners in this step -- just the correct position.

First, turn the cube over so that the (almost) solved layer is the *Down* layer, and then rotate the *Center* layer until the center squares match up with the *Down* layer.
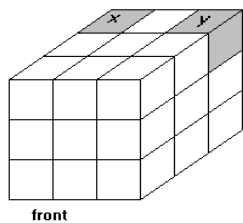
Rotate the *Up* layer until one of the following arrangements is true:
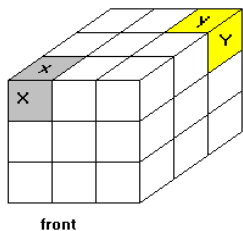
A.

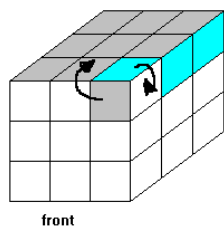If arrangement A (where X and Y have to be swapped diagonally)
Do: **UFURU^{-1}R^{-1}F^{-1}**

B.

If arrangement B (where X and Y have to be swapped horizontally)
Do: **FU^{-1}B^{-1}UF^{-1}U^{-1}BU^2**
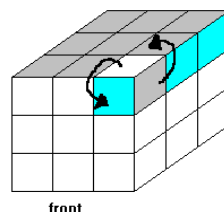
Repeat step (2) as necessary.

(3) Orienting corners. Hold cube so that a corner to be twisted *clockwise* appears as shown:

Do: $\mathbf{R^{-1}DRFDF^{-1}}$

then keep the cube steady and do the following ...

Rotate the *Up* layer only until a corner to be twisted *counter-clockwise* appears in the bottom-right corner position of the *Up* layer (as shown):


Do: $\mathbf{FD^{-1}F^{-1}R^{-1}D^{-1}R}$

Repeat step (3) as necessary

(4) Positioning and orienting edges. Hold cube with the (almost) solved layer on top, so that the unsolved edge (X) is lined up with a *Down* layer edge position that is also unsolved (W). Rotate the *Center* layer only until the correct edge (Z) is in the position as shown:
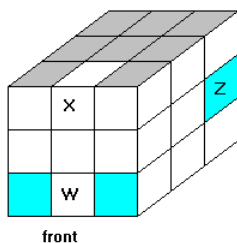

If edge Z should be in position W, and the color arrangements are as shown, do: $\mathbf{F^{-1}C{\leftarrow}F}$
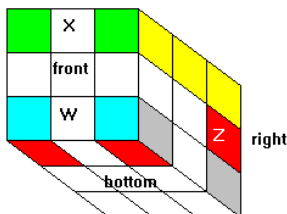
If edge Z should be in position W, and the color arrangements are as shown, do: $\mathbf{FC{\leftarrow}C{\leftarrow}F^{-1}}$
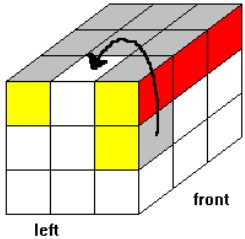
Continue to do step (4) until all edges of the *Down* layer are correctly positioned and oriented.

(5) Solve the unsolved edge of the Up layer. Rotate the *Center* layer only until either of the following situations occur:
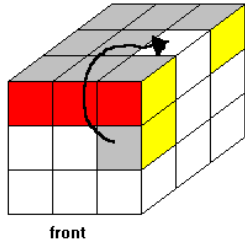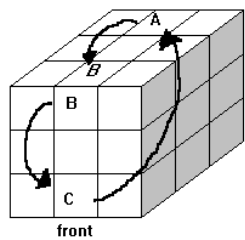

A.

If this arrangement, do: $C{\leftarrow}R^{-1}C{\leftarrow}RC{\rightarrow}R^{-1}C{\rightarrow}R$

B.

If this arrangement, do: $C{\rightarrow}LC{\rightarrow}L^{-1}C{\leftarrow}LC{\leftarrow}L^{-1}$

(6) Positioning the edges of the Middle layer. Hold the cube so that the solved layers are on the left and right sides, and the center squares of the *Middle* layer are in their correct positions. Hold the cube so that the following scenario occurs (see note below):

If edge A belongs in position B and edge B belongs in position C and edge C belongs in position A, do: $M{\uparrow}U^2M{\downarrow}U^2$

Note: if the scenario does not occur, perform the move sequence once; then repeat step (6).

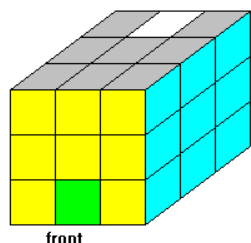**(7) Correctly orienting the Middle layer's edges.** Hold the cube with the solved layers on the left and right sides with the center squares of the *Middle* layer correctly positioned (as shown):

front
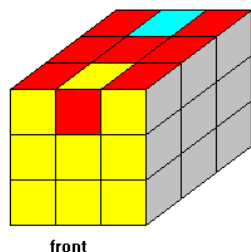
If you see this arrangement (where two *Top* layer edges need to be flipped),

do: $(M{\uparrow}U)^3U(M{\downarrow}U)^3U$

front

If you see this arrangement (where the edges to be flipped are diagonally opposite each other),

do: F^2 (**the above sequence**) F^2

Repeat step (7) as necessary.

The cube should now be solved!

If you have a picture cube or cube where center square orientation matters, do step (8).   Otherwise, see the last page for some patterns to try with a solved cube.

[*] **(8) Correctly orienting the center squares.**

Note: cubes with solid faces do not require this step.

A. If the center square on the *Up* layer needs to be rotated 180º

      do: $U\ RL\ U^2\ R^{-1}L^{-1}\ U\ RL\ U^2\ R^{-1}L^{-1}$
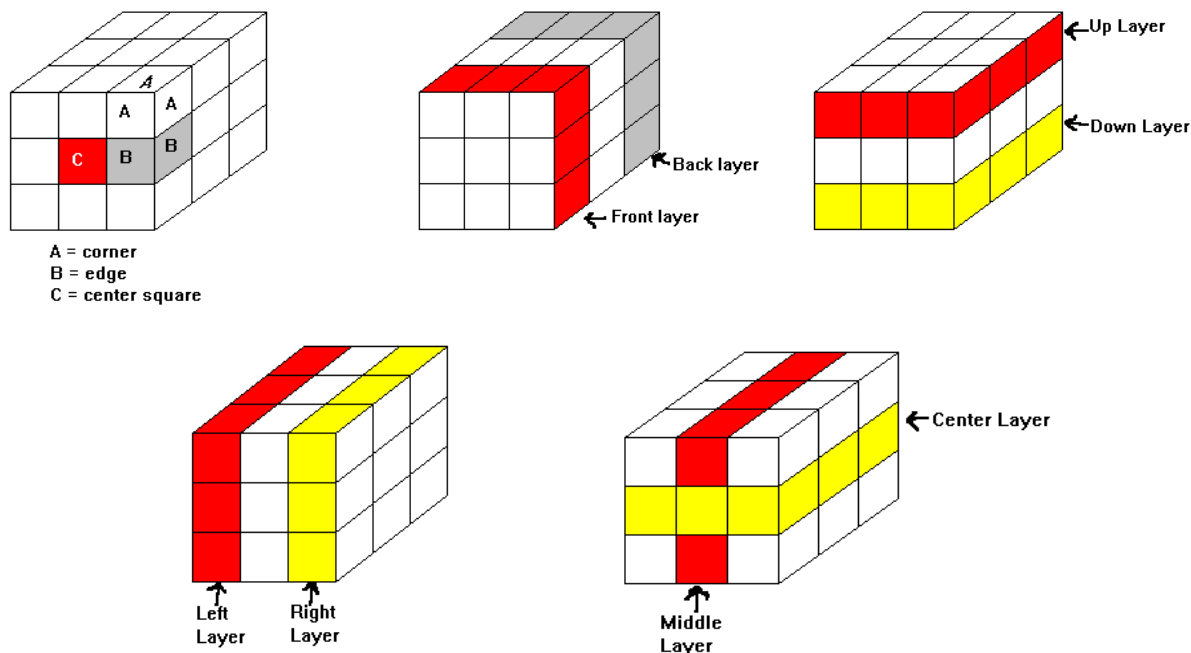
B. If the center square on the *Up* layer needs to be rotated clockwise, and the *Front* center square counter-clockwise

      do: $FB^{-1}\ LR^{-1}\ UD^{-1}\ F^{-1}\ U^{-1}D\ L^{-1}R\ F^{-1}B\ U$

C. If the center square on the *Up* layer needs to be rotated clockwise, and the *Down* center square counter-clockwise

      do: $RL^{-1}\ F^2B^2\ RL^{-1}\ U\ RL^{-1}\ F^2B^2\ RL^{-1}\ D^{-1}$

EXPLANATION OF SYMBOLS AND TERMS

A = corner
B = edge
C = center square

Back layer

Front layer

Up Layer

Down Layer

Left Layer

Right Layer

Center Layer

Middle Layer

Legend

F = Front layer	B=Back layer
D = Down layer	U = Up layer
R = Right layer	L = Left layer
C = Center layer	M = Middle layer

Explanation of Moves

X	Rotate layer X once **clockwise** (when looking directly at outer face of the layer)
X^{-1}	Rotate layer X once **counter-clockwise** (when looking directly at outer face of the layer)
X^2	Rotate layer X twice
C→	Rotate center layer once to the right
M↑	Rotate middle layer once up
(XY)^n	Do sequence XY n times

Note: the following move sequences are to be applied to an already solved cube.

1. Tiny cube within a cube
$(R^{-1} D^2 R B^{-1} U^2 B)^2$

2. Cube within a cube
B $L^{-1} D^2$ L D $F^{-1} D^2$ F $D^{-1} B^{-1} F^{-1}$ R $U^2 R^{-1} U^{-1}$ B $U^2 B^{-1}$ U F

3. The worm
R U $F^2 D^{-1}$ R L^{-1} F $B^{-1} D^{-1} F^{-1} R^{-1} F^2$ R U^2 F $R^2 F^{-1} R^{-1} U^{-1} F^{-1} U^2$ F R

4. The snake
R F $B^{-1} D^{-1} F^2$ D B $F^{-1} R^{-1} F^2$ U $R^2 U^{-1}$ D $F^2 D^{-1}$

5. The ring
D R $F^2 R^{-1} F^{-1} D^{-1} R^{-1} D^2$ R F^2 D $R^2 D^{-1} R^{-1} F^{-1} D^{-1} F^2$ D R

6. Horseshoes
$L^{-1} R^2 F^{-1} L^{-1} B^{-1}$ U B L F R $U^{-1} R^2$ F B^{-1} U D^{-1} R L^{-1}

7. Table
$R^{-1} L^{-1} D^2$ R L $F^{-1} B^{-1} D^2$ F B

8. Spots
C↑ F B^{-1} D U^{-1} C↑

9. Checkerboard
$R^2 L^2 F^2 B^2 U^2 D^2$

10. Oooo
C↑ $F^2 B^2$ C↑ $F^2 B^2$

11. Zig Zag
$(R L F B)^3$