

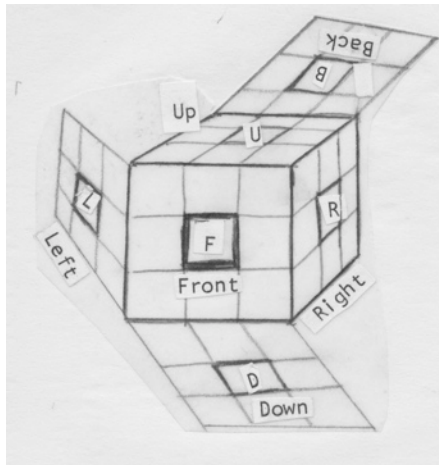
A Simple and Easily-Remembered Method for Solving the Rubik Cube

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Published by B.RUGGED
(<http://BRUGGED.com>)
11 South Adelaide Ave
Highland Park, NJ 08904 USA

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A scrambled cube is in your hands.



The six center cubies don't move.
They determine the colors of the six finished faces.

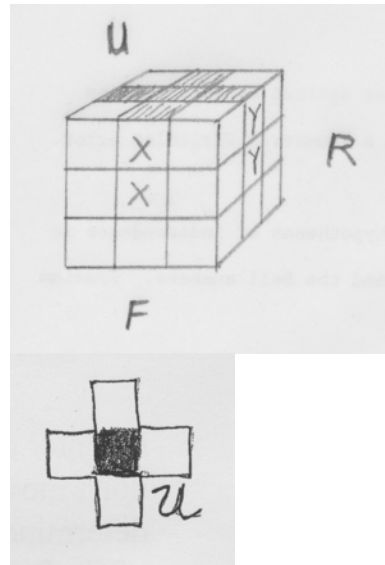
FRONT faces you. The other faces are **LEFT**, **RIGHT**, **UP**, **DOWN** and **BACK**.

A move turns a face a quarter-turn clockwise. **F** turns the **FRONT** face a quarter-turn to the right. **L R U D B** are clockwise turns of those faces. Get your hands to tighten an imaginary screw. Try not to think about this - it should become automatic!

The corresponding counter-clockwise or unscrewing moves are indicated by a dash, like this: **L'**. Again, your hands should do the unscrewing without you having to think about it.

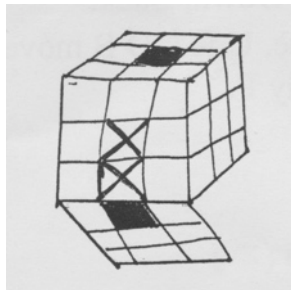
Thus **L'** means make a quarter-turn counter-clockwise of the **LEFT** face and **F'** turns the **FRONT** face a quarter-turn to the left. Likewise **F²** means two quarter turns of the **FRONT** face. Turning twice is the same in either direction.

OK, let's go! Place *white* (or lightest) center cubie face **DOWN** on the palm of your hand. On UP, the top layer (*yellow*, in our cube), we are going to make a colored cross with 2-sided edge cubies.

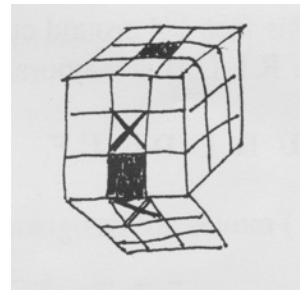


One color of each edge cubie will match the top layer's center cubie (*yellow*), the other color will match the **FACE** of one of the four sides. **X** will match **X**, **Y** will match **Y**, and so on.

As you find each edge cubie, move it so that it is on the **DOWN** layer facing the front. (If it was already on the UP layer, put it on the **RIGHT** and do **R² D' R²**, easy!) You will now see one of these two pictures:



Do **FF**

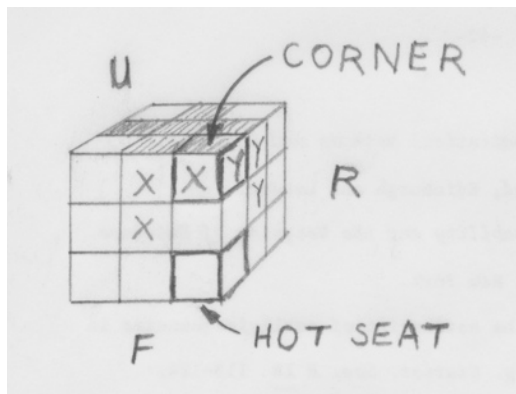


Do **D' L' F L**

To remember this sequence, think of two famous painters, **DeLacroix** and **Fra angeLico** (or two states, **DeLaware** and **FLorida**).

In the same way, do all four of the Upper layer's **CROSS** cubies.

Next we do the Upper layer's four corners. A corner cubie has three colors: the cross color (yellow) plus two colors that match the side faces (**X**, **Y**).

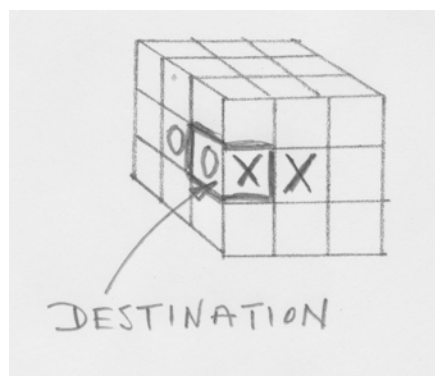


(If the corner cubie we want is already in the Upper layer but in the wrong position, put it at the Front Right and do **R' D' R** to bring it down to the bottom layer).

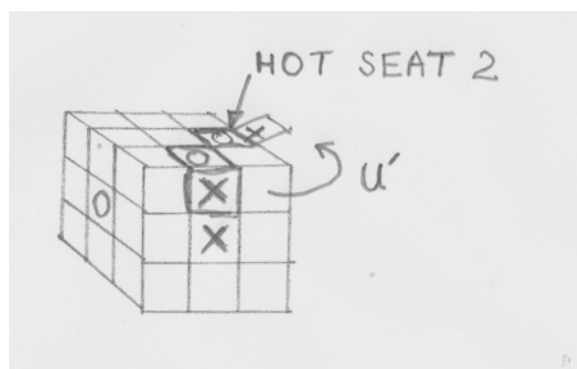
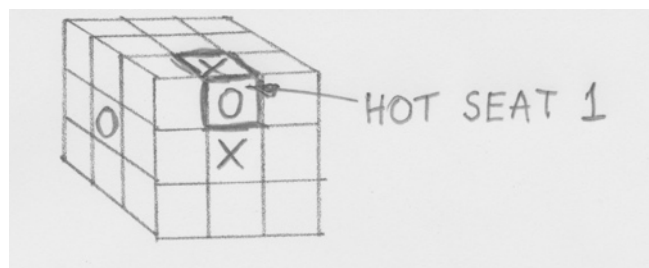
Now put the corner cubie in the hot seat (by doing **D**) and then do **R' D' R D** over and over until the corner cubie arrives at the top corner on upper layer. You might have to do it five times. To remember this, say *Roddy Roddy*.

In the same way, do all four of the Upper layer's CORNER cubies. We are now finished with the top layer.

The MIDDLE LAYER is next. We only have to fix the four edge cubies. Turn the cube so that white (or the lightest color) is UP. On UP locate an edge cubie (**O**, **X**) that we want to move to the middle layer.



Put it in Hot Seat 1. Then we will see that either the **O**s match (as in picture on left) or that the **X**s match (on the right).



If the **O**s match, then whisper ***we are not going to the party!*** The move is ***fuury fuury***:

$$\mathbf{F U^2 R U' R' U^2 F'}$$

(This is the same as $\mathbf{F U^2 R U' (F U^2 R)'$, hence the name ***fuury fuury***. We admit these are strange phrases to memorize. But that's the secret behind good mnemonics)

On the other hand, if the **X**s match, then we first do **U'** to put the cubie into Hot Seat 2, but in compensation ***we are going to the party***. The move is again ***fuury fuury***, but with **U** in the middle:

$$\mathbf{F U^2 R U R' U^2 F'}$$

If ***we are going to the party***, the middle move is **U**, but if ***not*** it is **U'**.

(What if the edge cubie we want is already in its correct position in the middle layer, but with its colors reversed? In that case we do the first ***fuury fuury*** move to bring it to the Upper layer, and then proceed as above.)

Do this for all four edge cubies in the middle layer, and you have now finished two layers.

The THIRD LAYER is the hardest. We will do it in four stages.

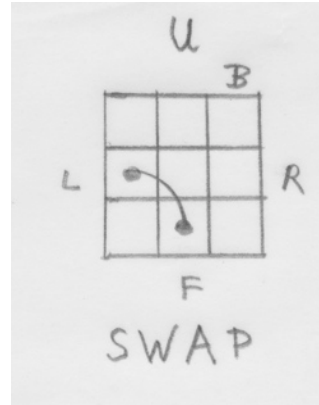
- I. Put the edge cubies in the right place, ignoring orientation.
- II. Put the corner cubies in the right place, ignoring orientation.
- III. Fix orientation of edge cubies.
- IV. Fix orientation of corner cubies.

Stage I. The goal is to get the four edge cubies into the correct position in the Upper layer, even though their orientations may be wrong. E.g., we might move the Yellow-Red cubie to the place where the Yellow and Red faces meet, without worrying about which of Red or Yellow is on top.

We do this by repeatedly swapping 2 edge cubies, The swap move is:

U FRU R'U'F'
you through ("fru") roof

Swap adjacent edge cubies until all four are in their correct place. You can often cut down on the number of swaps needed by *rotating the upper layer*. Color orientation is fixed later.

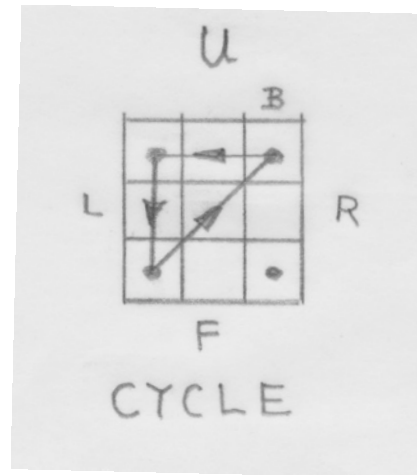


Stage II. Next we put the corner cubies in the top layer into the correct position, again without regard to orientation.

If you are lucky, one of the four corners will already be right and the other three wrong. In that case, put the correct one in the Upper Right Front corner, think of the **Urul Mountains**, and do

URU' L' UR' U' L

This is a cycle of length 3, so you may need to do it twice.



What if all four corners are wrong at the start? In that case do **URU' L' UR' U' L** once so that you end up with one right and three wrong, and then proceed as above.

Stage III. Fixing the orientation of the edge cubies in the top layer. Here we introduce a new move called **East**: this rotates the middle layer a quarter turn to the right while keeping the top and bottom layers fixed.

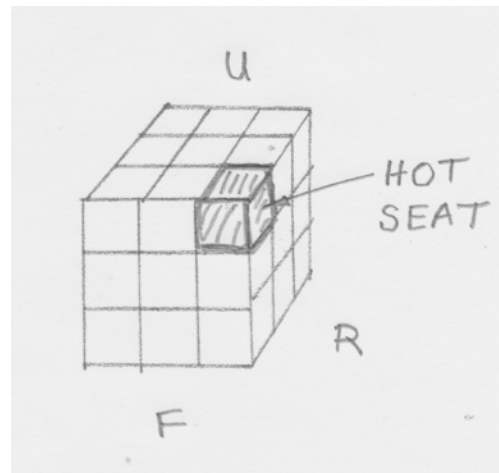
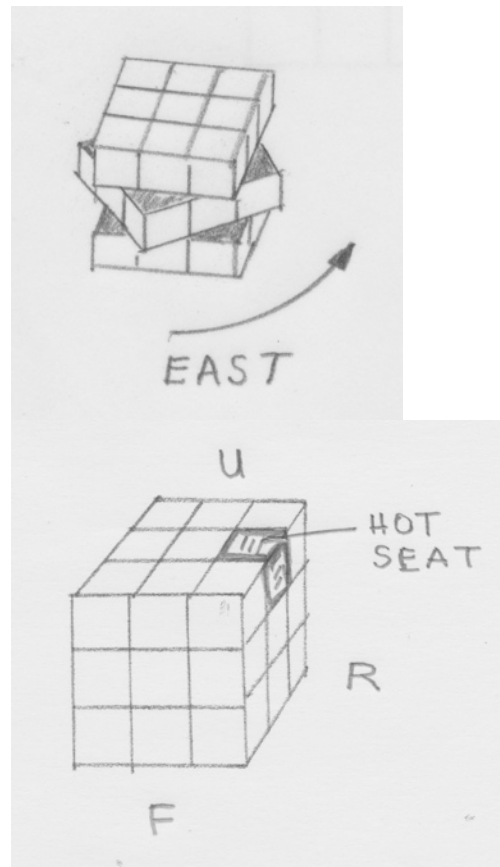
There will be 0, 2 or 4 edge cubies that need to be flipped. Move one edge cubie that needs to be flipped into the Hot Seat. Before you do the move, make a mental note of which other edge cubie you want to flip too.

The flipping move is **East Right** repeated four times: $(ER)^4$.

After you have done this, hold the cube very tightly, so that you don't forget which face is the **Front**, and using only **U** moves, put the other edge cubie to be flipped into the hot seat, and again do $(ER)^4$.

This will flip the orientations of two edge cubies (you will have to use **U'** to undo the **U** moves you did). If all four edge cubies needed flipping, you will now have to do another pair of $(ER)^4$ moves.

Stage IV. The last stage! Correcting the orientations of the corner cubies. To do this we use a move that rotates one corner cubie **clockwise** and another corner **counter-clockwise**.



Move a corner cubie that needs to be rotated **clockwise** into the Hot Seat. Before you do the move, make a mental note of another corner cubie that you are going to rotate **counter-clockwise**. Then do

R' D R F D F'

Whisper *radar fin-dif* to remember it.

After doing it, again hold the cube very tightly so you don't forget which face is the **F**ront, and using only **U** moves, put the corner cubie to be turned counter-clockwise into the hot seat. Now do the inverse of the *radar fin-dif* move, which is **F D' F' R' D' R**, and again undo the **U** moves you made.

You may have to do one more pair of moves like that to get all four corner cubies oriented correctly, but if you haven't made a mistake, you will now be FINISHED! Congratulations!

The more often you do the Rubik Cube the better your skill improves. When you're frustrated just re-read the directions and follow them exactly. Remember to LOOK at your cube before and after moves.

If you make a mistake, you will probably have to start from the beginning. Don't worry, this is Nature's way of making sure that you have memorized all the moves correctly.

We wrote this note to help some friends who were having trouble unscrambling the cube. We believe our mnemonics are new, although the sequences of moves certainly are not (we learned most of them from John Conway thirty years ago).