

## Notes About The Rubik 2x2x2 Three Step Solution

### Step 1:

Get three corners right, move two of the correct ones 90 degrees, move the fourth into position, and move the two correct ones back. If the 4th corner is rotated so it won't position correctly, do a full 180 degree turn of that side and then you can reposition it to try again. In any case, even if this description is hard to follow, after playing a bit, this step becomes easy.

### Step 2 - a simpler but slower *randomized solution*:

As summarized on the next page, this step could be replaced by:

*Step 2.* If possible, rotate the up layer to be correct, except some corners may be rotated; otherwise, mix up and go back to Step 1 using a different color on the bottom.

(Starting from a random position, there is a 1 in 6 chance that this test succeeds. So even if a quick mix and starting with a different bottom is not completely random, once you get reasonably fast at doing Step 1, it shouldn't take too long.)

### Step 2 - making it faster:

This step can be used three times for a diagonal exchange. However, since it does not change the upper back left corner, it is faster to do UBL  $\leftrightarrow$  UFR by preceding the transformation with L and skipping the final L.

### Step 3 - making it faster:

Every iteration of the corner rotator exchanges UFR and DFR, and repeating it 6 times returns the cube to exactly where it was. Step 6A will use the corner rotator 2 times if the top color is on the right side of the UFR corner, but 4 times if it is on the front, in which case it is faster to do the reverse sequence 2 times:

*reverse corner rotator:* **D- R- D R**

### Step 3 - why it works:

- Step 3A affects only 4 corners by exchanging two front right corners and also exchanging the two back down corners.
- Doing Step 3A twice leaves corners in the same positions, except those four corners are rotated, and doing Step 3A six times leaves the corners the same as when you started.
- On the up layer Step 6 only modifies the front right corner.
- Since Step 3 started with the bottom corners correct, once three of the four top corners have been fixed, fixing the fourth top corner must leave the bottom corners correct. This is because when at every 6th move the two back bottom corners are correct, all that is left that could be incorrect are the two front right corners, but due to parity considerations, a completely solved puzzle except for two adjacent rotated corners is not possible.
- This transformation also works for a *Rubik 3x3x3* cube (and is the last step of the layer by layer solution presented on that page). The only edge pieces that are affected are FR, RD, BD, which are on the lower two layers; they return back to where they were after 6 moves.