
Modular Solution Introduction


Optimization #1 - Positioning the first 4 edges faster

Modular Solution Introduction

Author: Blake

There are many Rubik's Cube solutions on the internet that boast that they are easy to learn. These are excellent if this is the first you've picked up a cube and you just want to learn how to solve one, even if the solution can only solve your cube in 10 minutes (or longer) with several days of practice.

Then there are other Rubik's Cube solutions on the internet that boast that they are the fastest solutions. These are excellent for those of you who are fed up with your slow 10-minute solution and want to be able to participate in Rubik's Cube contests and solve them in under a minute with months of practice.

This solution is different. This is written to be the most watered-down solution possible. You probably cannot find a simpler solution to learn. However, unadorned, this solution will take a very long time to solve your cube. Occasionally I'll add some optional shortcuts to this solution. Some will be really simple (so simple, in fact, that you will have probably figured them out on your own after solving a cube a few times). Other shortcuts, on the other hand, will be rather difficult to understand but will really shave down your solving time. Which optimizations you choose to learn is entirely up to you. You could just learn the bare-bones solution and solve a Rubik's Cube in 4 hours. On the other hand, you could spend lots of time learning the optimizations to the solution and you could solve a Rubik's Cube in 30 seconds from any scrambled state.

The beauty and advantage of this solution is you can start off slow and get the results you want.

...and if you want to improve later, you can do so without learning an entirely new solution from scratch.

Some Quick Terminology

- **Piece** ? The word "piece" refers to the physical piece of plastic that has stickers on it.
- **Corner** ? The word "corner" will refer to corner pieces. A corner has 3 stickers on it. There are 8 of them.
- **Center** ? The word "center" will refer to the square in the middle of each face.
- **Edge** ? The word "edge" refers to the remaining type of piece. Edges have 2 stickers on them. There are 12 of them.

How the solution works

To start off, I'm going to teach you 4 sequences of moves.

The first sequence of moves, when used, will swap the positions of two edge pieces. Which two pieces it swaps will depend on which way you're holding the cube when you start making the moves.

The second sequence of moves, when used, will make two edge pieces flip their directions.

The third sequence of moves, when used, will shuffle the positions of 3 corner pieces. The corners it moves will depend on the orientation of your cube when you start executing the sequence.

The final sequence of moves, when used, will rotate the orientation of 2 corner pieces in place without changing their positions.

All you have to do is memorize these 4 moves and use them repeatedly to be able to solve a cube...

- Phase 1: position all the edge pieces
- Phase 2: orient all the edge pieces
- Phase 3: position all the corners
- Phase 4: orient all the corners

That's all there is to it.

Quick note

The stickers that are on a piece of plastic will always stay on the same piece of plastic. That means no amount of twisting will cause a green edge piece to move to a corner.

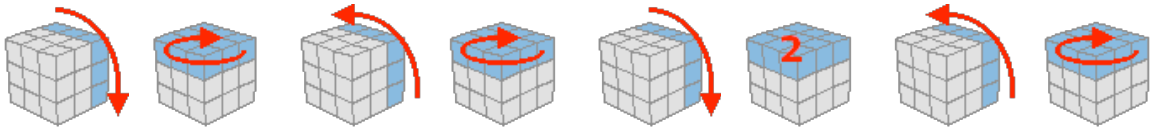
The centers are always correct. They never move. They only rotate in place. Their positions always stay the same with respect to each other. So technically, they were in the same position when your cube was solved as they are now. We will use the centers as a frame of reference in which we will place the other pieces.

With these two ideas in mind, it becomes clear that the edge piece that has the red and green stickers on it will ultimately end up nested between the red center piece and green center piece. If you were to place an edge that had the red and blue stickers on it between the red and green centers, then that doesn't count as "being close". It's a wrong piece in the wrong place.

The 1st sequence: Swapping two edges

First pick out two edges next to each other that you want to swap. Hold the cube so that they're located in the highlighted spots:

And do the following moves...



To memorize this move, notice that the right side keeps going back and forth and the top is always moving clockwise except for that one time you turn it twice. When you turn a side twice it doesn't matter which direction you turn it. It's 180 degrees either way.

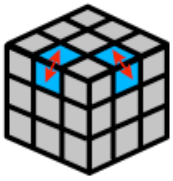
Use this move repeatedly in different places until you have all the edges in the correct places.

Once you're done, your cube should look like this:

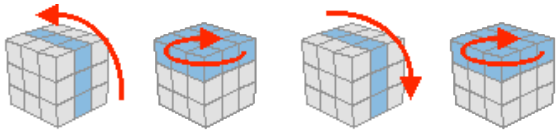
Notice how all the edges pieces in this picture are in the correct places, but not necessarily turned the correct way. See how the red-blue edge piece is directly between the red and blue centers? Doing this for all edges is our only goal in this step. We will fix the orientation of the edges in the next step.

The 2nd Sequence: Flipping two edges in place

Now pick out two edge pieces that need to be flipped in place. Turn the cube so they are next to each other like this:



And do the following moves...



(then repeat 2 more times)

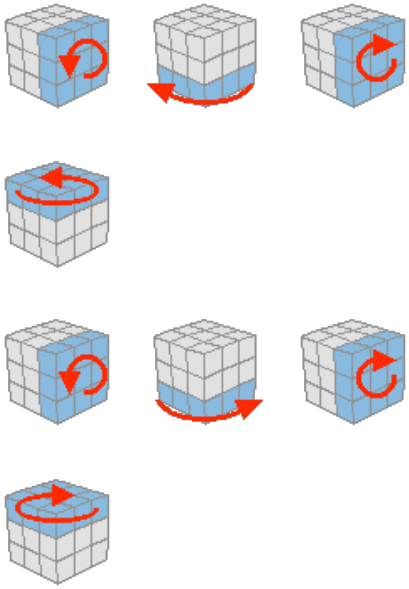
Keep doing this over and over until all the edges are correctly oriented. If you have two edges that you need to flip but they aren't conveniently adjacent to each other, then you'll have to mess some edges up between them and do the move a few more times.

Eventually, your cube should look like this:

The 3rd Sequence: Shuffling corners around

This next move will take 3 corners and shuffle them around like this:

So hold your cube in such a way that this does something productive and do these moves...

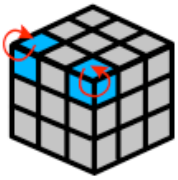


Keep doing this over and over until all the edges are correctly positioned. If you have two edges that you need to flip but they aren't conveniently adjacent to each other, then you'll have to mess some edges up between them and do the move a few more times. Eventually, your cube should look like this:

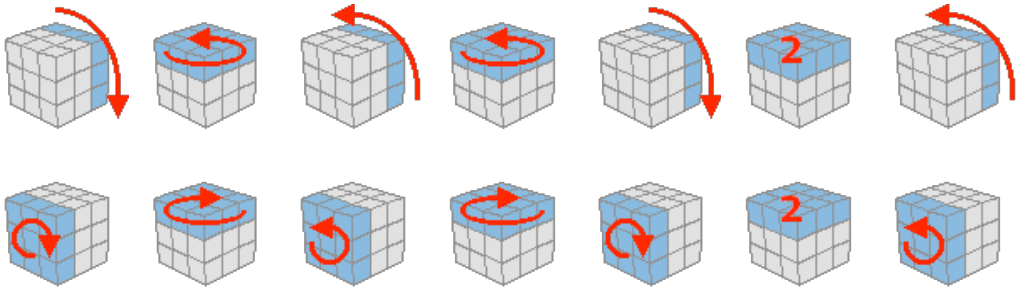
Notice that all the pieces are in the correct place. Some of the corners just need to be rotated in place. This is what we'll do in the last step...

The 4th Sequence: Rotating Corners in Place

This next move change the orientation of two adjacent edges. Hold the cube so that the two edges are next to each other like this...



And do the following moves...



Notice that the second row is the same as the first mirrored on the other side of the cube.

Sometimes the 2 corners you want to rotate aren't conveniently next to each other. In this case use this sequence to solve one of the corners while at the some time mess up one of the adjacent corners that's closer to the other corner that needs to be oriented.

And eventually, by doing this over and over, your cube will be solved...

User Comments

Rodents says... An amazingly beautiful guide; I've been meaning to try to learn this way as well; thanks =)

llanoda says... I've been trying to solve cubes since grade school but in all those years I was nt able to solve any,...

See full comments/Add a comment

8 Summer 6:3
9.94.89

Optimization #1 - Positioning the first 4 edges faster

Author: Blake

(This is an additional optimization for my Modular Rubik's Cube Solution. Please be sure to read that first.)

Swapping just two edges without disrupting the rest of the edges is quite tedious. However, it is also unnecessarily long when you don't have most of the edges solved anyway.

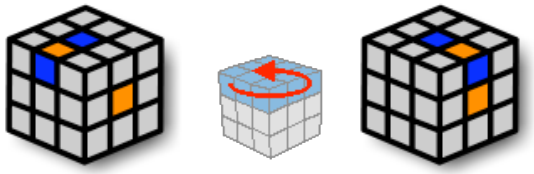
Rather than using an 8-move two-edge-swap to position the first four edges, you can easily use a sequence of 2 or 3 moves instead.

A better way to approach this is to first pick out a color. Find the center piece that has that color. Hold the cube such that this center is on top. I will refer to this side as "top" from now on. (I have selected blue as my top color in the examples below)

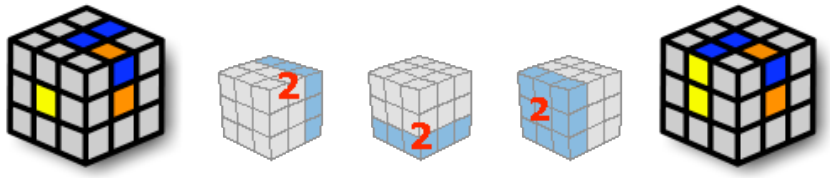
Now look around the cube for an edge piece that has that color also. It could be in one of 3 places.

It could already be next to that center piece.

If this is the case, then you can simply turn that side until this edge is nestled between the two correct center pieces if this is the first edge that you are positioning.

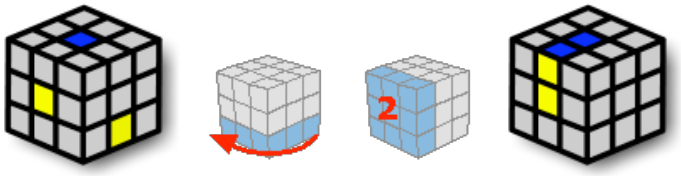


Otherwise, you can avoid disrupting any progress you've made so far by turning the side face twice to move the edge piece to the bottom, then turning the bottom such that the edge is below where you want it to ultimately go, and then turning that side face twice. Like so...



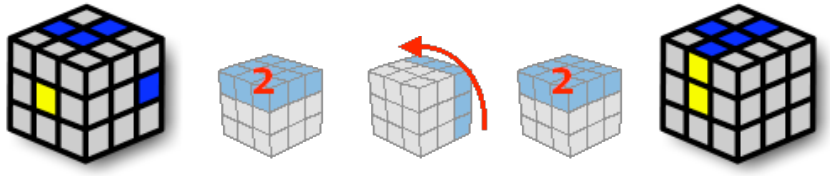
It could be on the bottom

If it's on the bottom, then all you have to do is turn the bottom so that it's directly below where you want it to go, and then turn that side face twice.



It could be on the side somewhere

If it's on the side, turn the top so that the edge is next to where you want it to go, and then turn that side 90 degrees. Remember to turn the top back to where it was after you turn the side so that all the edges are still aligned correctly with the adjacent centers.



And remember, the orientation of the piece does not matter for the purposes of this optimization. That will come another day in another optimization.

User Comments

There are no comments on this article yet. Would you like to make one?

8 Summer 6:3
9.97.15

 Introduction

 Step 1: Solving One Side

 Step 2: The Middle Row

 Step 3: Orient Bottom Corners

 Step 4: Orient Bottom Edges

 Step 5: Position Bottom Corners

 Step 6: Position Bottom Edges

Introduction

Author: Blake

First of all, you will not be able to solve a Rubik's Cube immediately after reading this page only once. It takes a lot of work to learn this method thouroughly. The time it takes to learn depends on your devotion. I have friends that every once and a while return to this page thinking they can learn the entire thing in the couple minutes of online time they have, and they have yet to solve a Rubik's Cube. On the other hand, I have friends that have learned the entire solution in about a day of intense memorizing. If you are serious about learning how to solve a cube, I suggest that you don't start learning until you know that you will have a lot of spare time in the near future to work on it. Print these pages out if you want to.

Another thing I'd like to say is that this solution won't break any world records. If you learn this solution thouroughly, your best time might be around a minute or a minute and a half. Once you get this method down pretty good, and you want to work on your solving time, I suggest you learn the Fridrich Speed Cubing Method. Pretty soon, I'm hoping to put a page on here about easing into the speed cubing method from the simple solution I have here.

Axioms To Keep In Mind:

- The cube consists of 21 individually moving parts. These include 1 triple-axis, 12 edge pieces, and 8 corner pieces.
- A center square will always remain a center square no matter how you turn the cube.
- An edge piece will always remain an edge piece no matter how you turn the cube.
- A corner piece will always remain a corner piece no matter how you turn the cube.
- Center pieces never change their position in relation to each other. They only twist around in place, even though it looks like they change places.
- An edge piece has two stickers on it. Those two stickers will always stay next to each other. If you want to move one of the colors to another position, the other has to come too. The same idea goes for corner pieces.
- Peeling off the stickers is not the solution (in fact if you start to peel off some of the stickers but never finish putting the rest in their places, you are most likely going to cause an impossible combination and make the cube unsolvable). Even if you do finish replacing the stickers, you make solving the cube more difficult and awkward to a person who actually knows how to solve it since the colors are not in the same place in relation to each other.

Something I'd like to get cleared up first before you start:

There is a difference between oriented and positioned. If a segment is in the wrong place, it is said to be in the wrong position. If a segment is in the right place but is facing the wrong way, then it is oriented incorrectly.

Solution Outline | Step 1 >

User Comments

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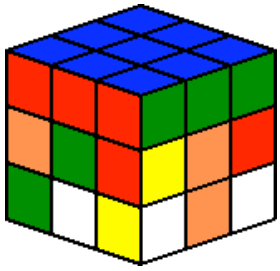
Step 1: Solving One Side

Author: Blake



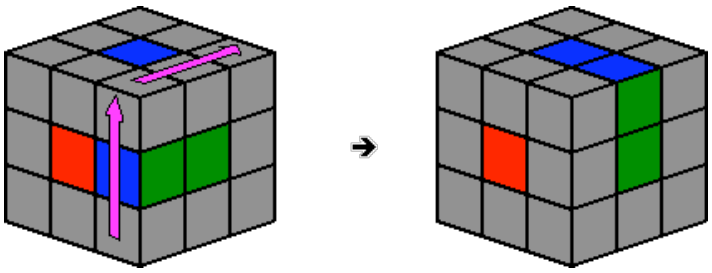
Solving the top row is the hardest part of the solution, believe it or not. Keep in mind that when you solve the one side, you have to solve the adjoining row at the same time. That means that if you decided to solve the blue face first, it would have to look something like the above picture. Notice how the red and green squares are all lined up nicely in the top row. Up to the challenge? Here we go...

Step-by-Step Instructions:

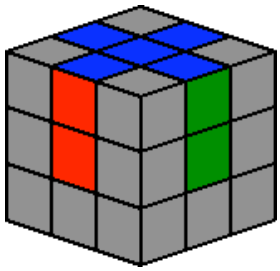
1. Don't Panic
2. Pick a color of the six (I will be using blue in most of the examples, so whenever I say blue, I *really* mean top color).
3. Find a sticker of that color that is in the center of the face. This will be your top.
4. Move the corresponding edge and corner pieces of that color next to the center cube while making sure the top outside row colors line up (may the thinking juices flow).

Let's break down that last part...

What you're basically trying to do is this:

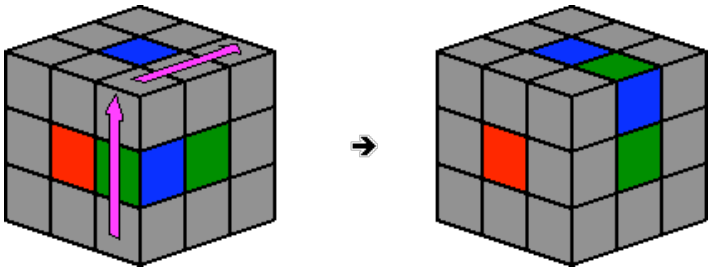


When you're trying to do this for the first time, it's always a good idea to solve the edge pieces first, so you have a cross on the top like this...

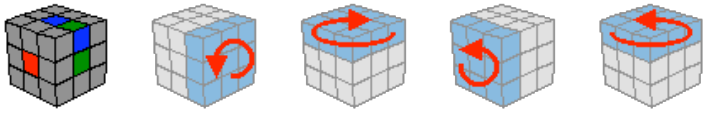


This will make positioning the corners easier.

However, sometimes you will get this little dilemma...



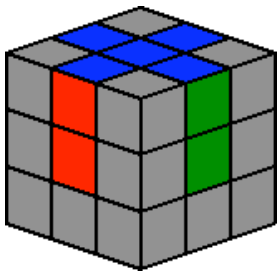
Here's what to do if that happens:



Click here for animation

When moving an edge piece to its place, make sure that while you're turning the sides it doesn't interfere with the edge pieces that are already in place. Move the top side so you can avoid messing up what you've done already.

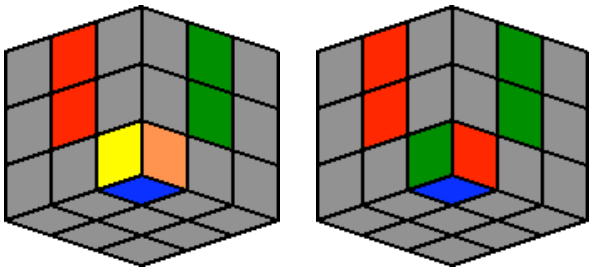
Always remember to make sure that the colors on the side of the edge pieces line up with the other center squares (VERY IMPORTANT)...



Once you've got that down, you can move on to solving the corners.

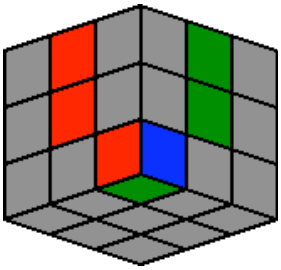
If the corner you want to move is on the bottom row, move it directly underneath where you want it to go. Remember that the colors have to match up when it gets to the top row. So don't move a corner piece that has blue, yellow and orange on it directly underneath the blue-red and blue-green edge pieces.

Wrong: **Right:**

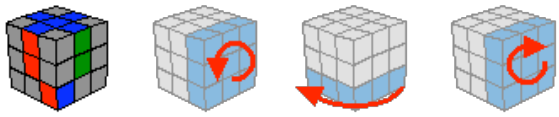


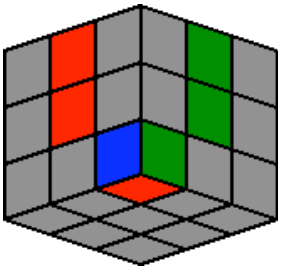
There are three ways to move this corner to the top row without disrupting any edge pieces. Depending on how the corner is oriented, you can decide how to move it.

The "2" means to turn that side 180 degrees. It doesn't matter which way.

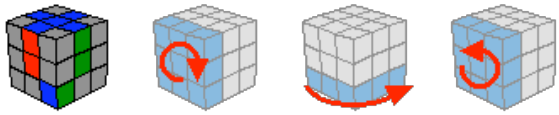


Blue sticker is facing right:

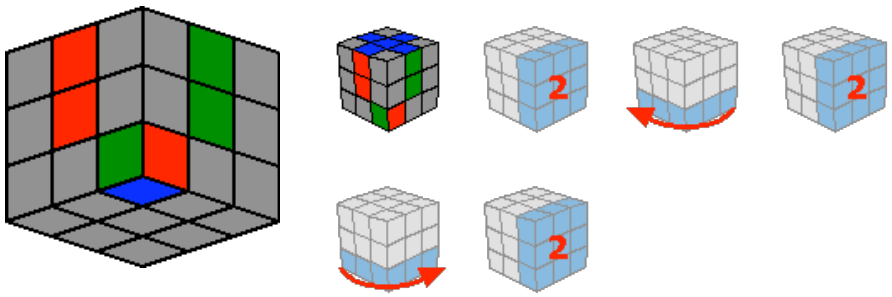




Blue sticker is facing left:

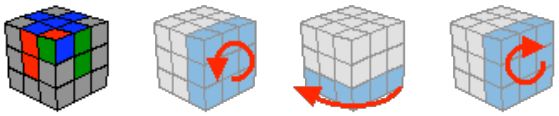


Blue sticker is facing down:

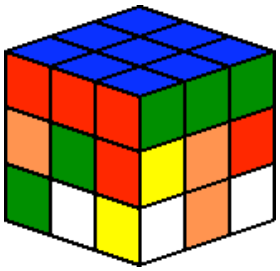


What if the corner you need is on the top row already, but is in the wrong place or has the wrong orientation?

Do this while holding the cube so that the desired corner is in front:



The piece you need is now on the bottom row somewhere to the left. Crisis Solved.



Look what you've just done.

< Introduction | Solution Outline | Step 2 >

User Comments

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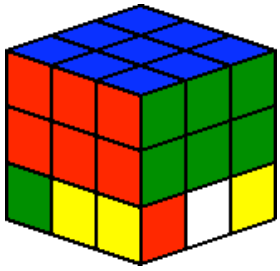
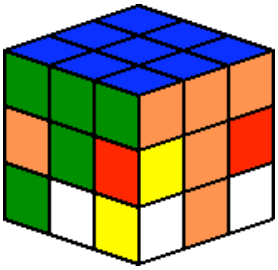
Step 2: The Middle Row

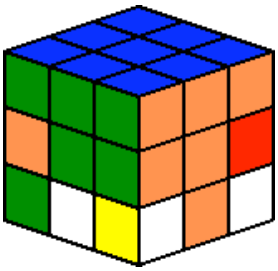
Author: Blake



Now twist the top face so that the center cube on each adjoining face matches in color with the three squares above it so they make small T's on each side, like so.



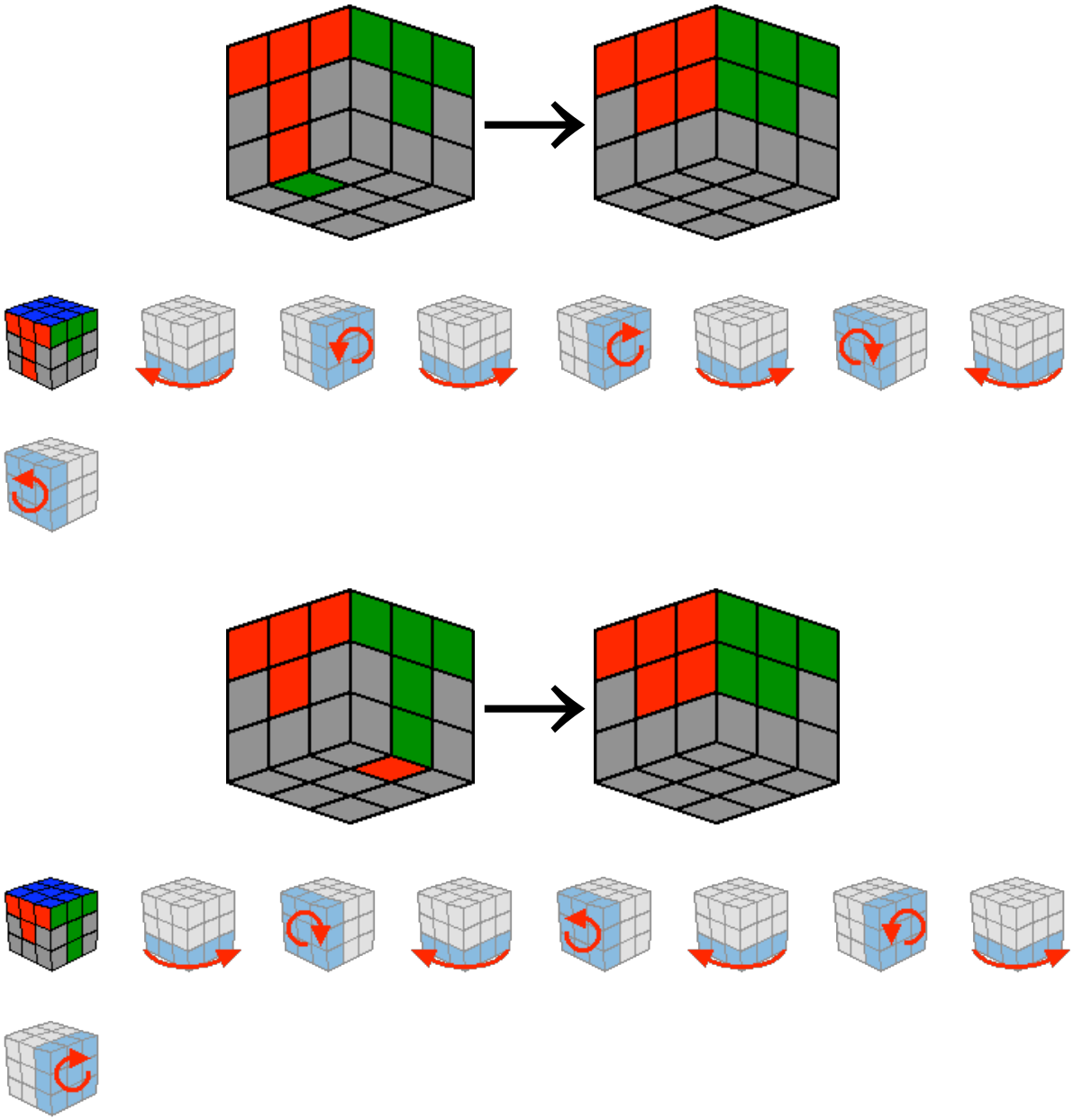
You can tell that an edge piece that has green on one side and orange on the other side goes in the middle of the picture above in order for it to look like this:



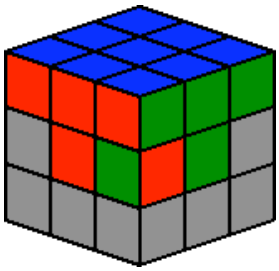
Look at the bottom face on your cube. Figure out what your bottom color will be; it should be the same color of the center sticker on the bottom.

Now look at the edge pieces on the bottom and try to find one that does not have the bottom color on it. That means that this edge piece should go in the middle row.

The next two algorithms show you how to move a piece from the bottom row to the middle row. Keep in mind that the colors given are only examples of what the color scheme on your cube could possibly look like. (red is front, green is right)

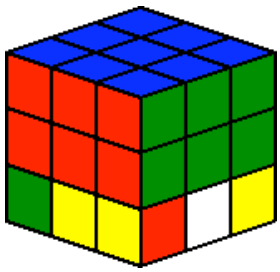


If a piece is in the middle row, but is not in the right place or is oriented incorrectly such as this red green edge...



...then pick a random piece from the bottom row. Pretend that this random piece from the bottom row is the red green edge piece and solve it. Once you put this wrong piece in the red-green's spot, then the real red green piece will fall back to the bottom row. Once the real red green piece is in the bottom row, then you can position it in a normal fashion using the steps above.

Now, how about that...



< Step 1 | Solution Outline | Step 3 >

User Comments

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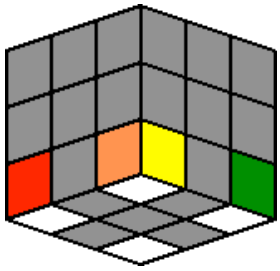
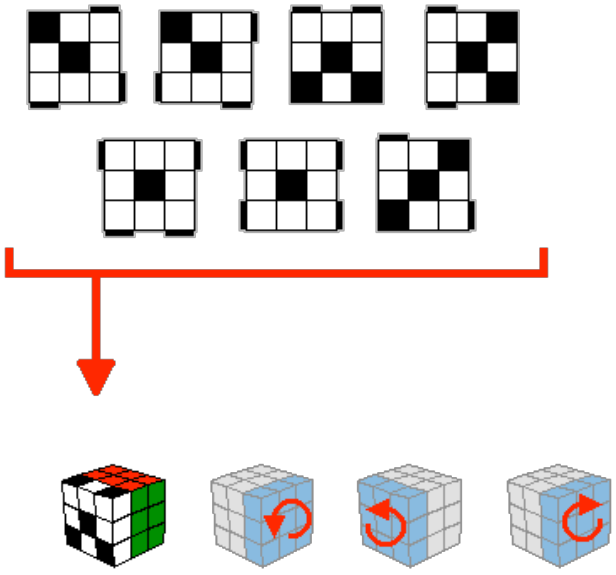
Step 3: Orient Bottom Corners

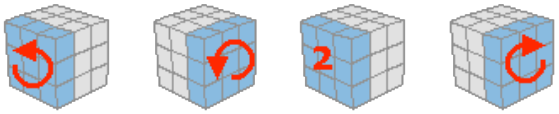
Author: Blake



This next step is one of the most commonly misinterpreted steps in the entire solution so pay careful attention...

Next, you must orient the four corners. Compare the four corners on the bottom of your cube to these pictures. Disregard the non-corner pieces on the bottom of your cube. Skip this step if they are all oriented correctly. The whole point of comparing the bottom is to determine how to hold the cube for the next move. The black spots represent the bottom color of your cube. These are all the possible combinations of corner orientations. Figure out which one looks like the bottom corners on your cube. Now hold the cube so that it looks exactly like the way it does here. You may have to rotate it to get it to match.

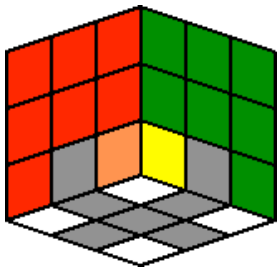




Note: Remember that '2' means turn the indicated face twice. It does not matter which direction you turn it. It'll end up the same either way.

Now go back to the beginning of this step and keep on doing this until all four corners are oriented properly. If you do it right, the most you should have to do this process is three times. Sometimes you'll get it on the first try. Sometimes you may get lucky and can skip this step altogether.

Getting There



< Step 2 | Solution Outline | Step 4 >

User Comments

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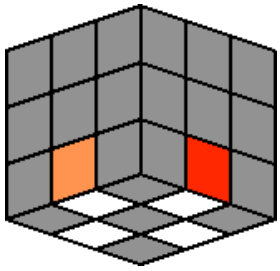
Step 4: Orient Bottom Edges

Author: Blake



There are only 4 bottom edge orientation possibilities at this step. If your cube doesn't match one of these, then somebody's been peeling your stickers. This step's pretty simple. Ignore gray squares; white squares are the ones that need to be oriented. Hold the cube as you see it shown in the picture. If you don't hold it so that the white in the picture corresponds exactly to where disoriented edges are, you may do some moves destructive to your progress.

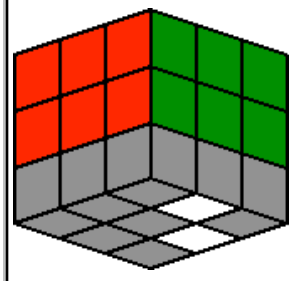
These moves are fairly simple to memorize because they always follow this pattern:

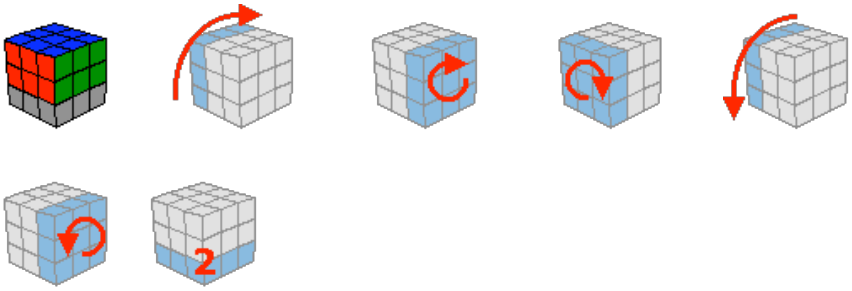
Left Up, Right Up, Turn the Front Somewhere,

Left Down, Right Down, Turn the Bottom Somewhere,

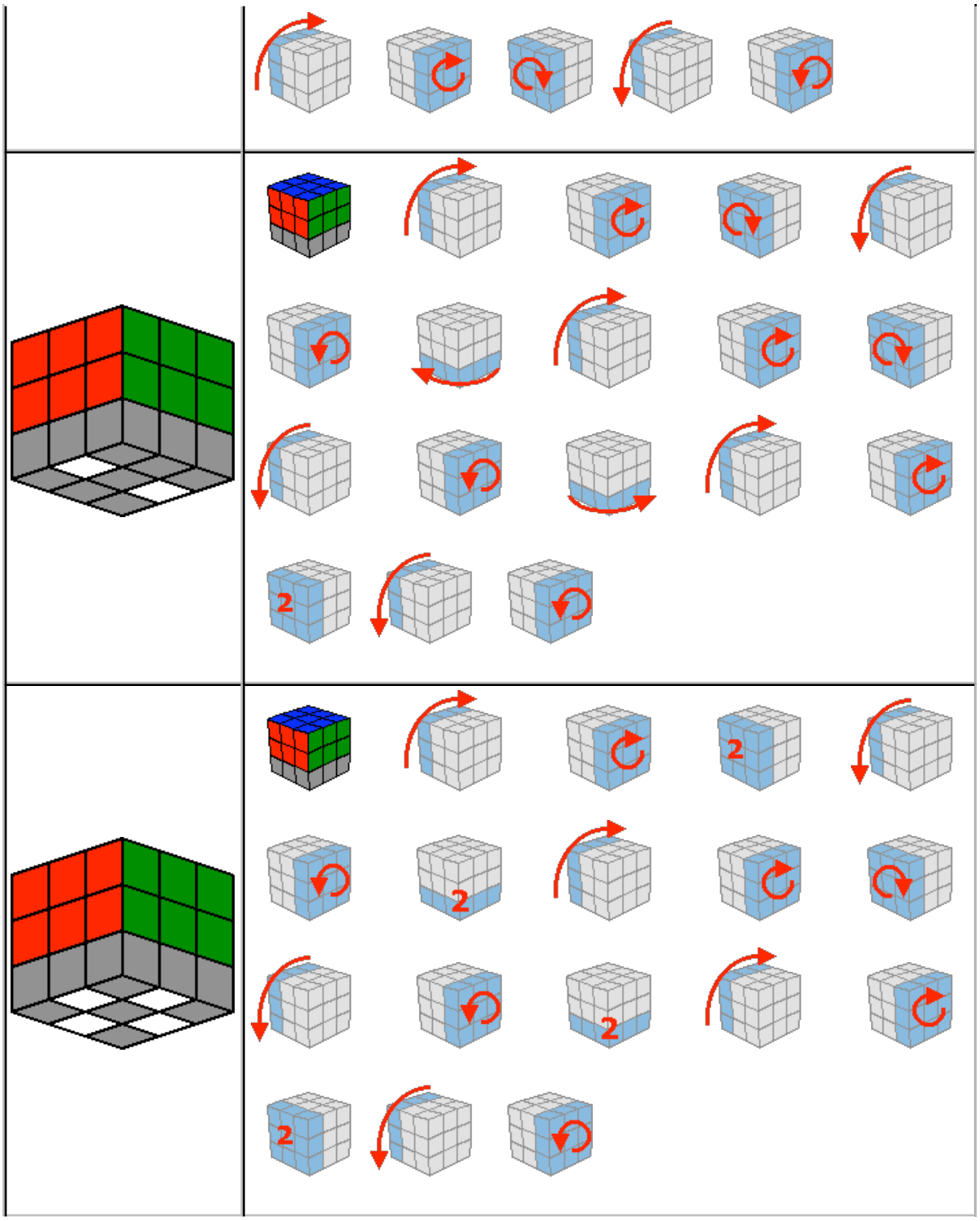
Repeat.

Simply tilt the cube towards yourself to make the big diagram look like the mini diagram and directions. White squares represent edges that are not oriented correctly.





(The second half of this move is almost an exact repeat of the first!)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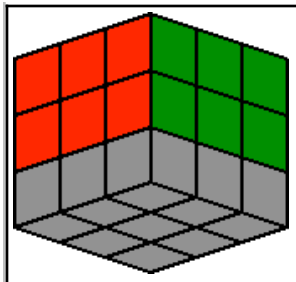
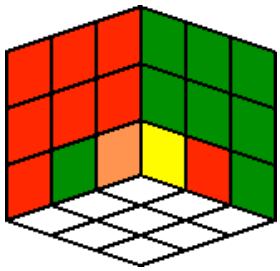


It's already oriented silly!

Ever So Close...



< Step 3 | Solution Outline | Step 5 >

User Comments

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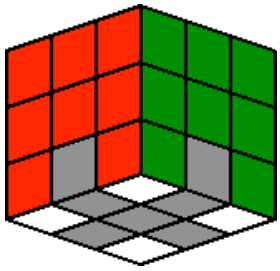
8 Summer 6:3
10.1.63

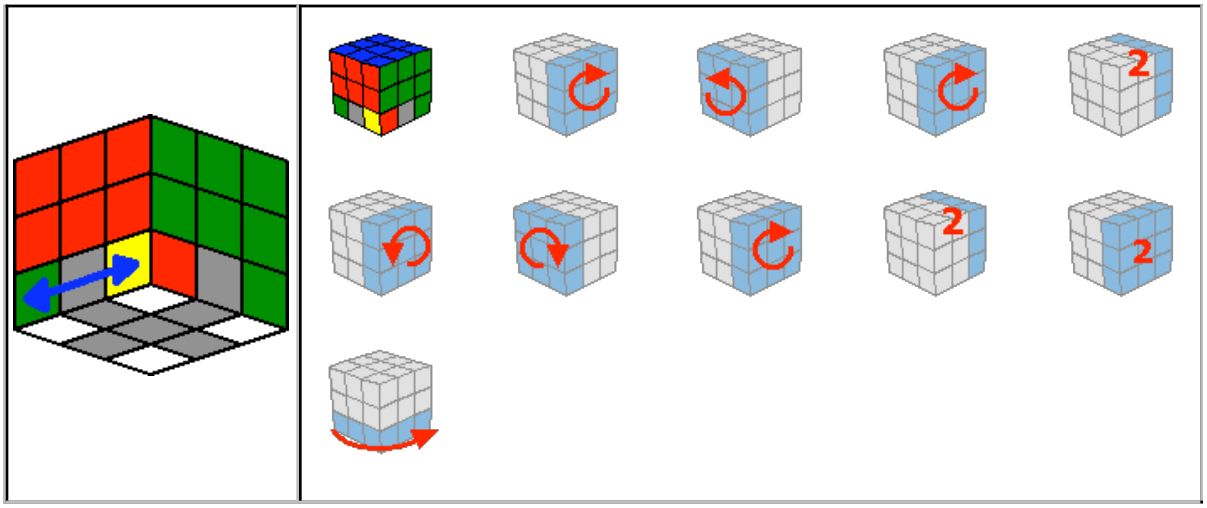
Step 5: Position Bottom Corners

Author: Blake



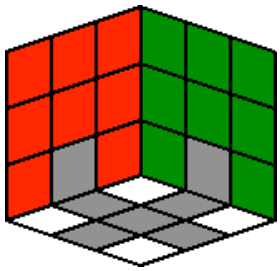
There is only 1 move to memorize in step 5! *relief-sigh*

This move will switch the places of the two corners in the bottom front without changing their orientation...



Continue using this move until all 4 corners are in the correct place. Edges still do not matter at this point.

Just One More Step To Go...



< Step 4 | Solution Outline | Step 6 >

User Comments

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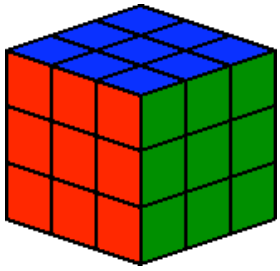
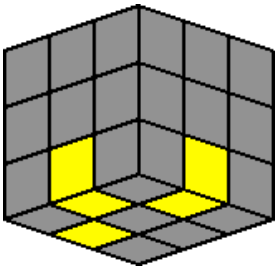
Step 6: Position Bottom Edges

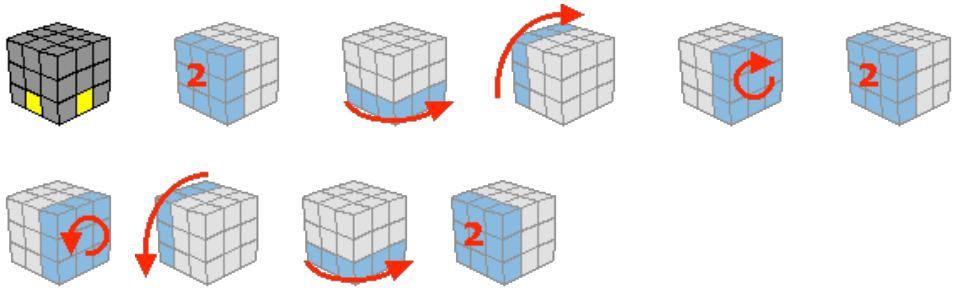
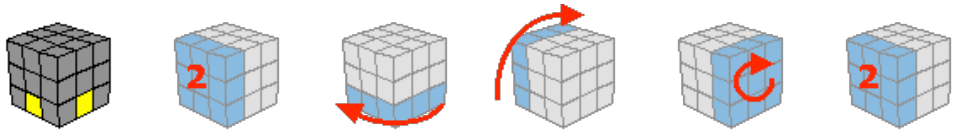
Author: Blake

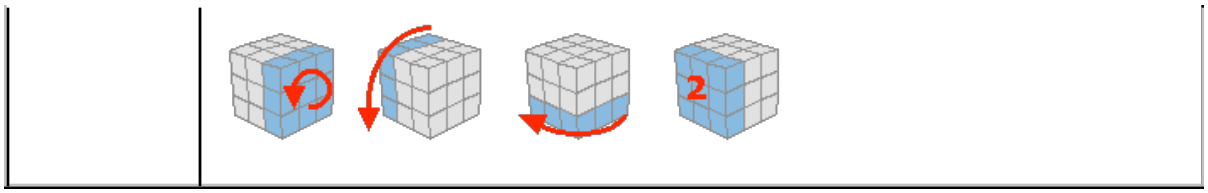


Only 2 moves to memorize in this step. (But they're so similar it should only be counted as one)

These moves will rotate the following edge pieces...

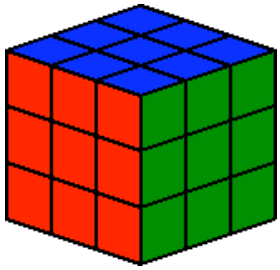


To rotate clockwise:	
To rotate counter-clockwise:	



You can use this 3-edge switch algorithm over and over again until all edges are in place, which means...

You're Finished. Congratulations!



Note: if you are using a Rubik's Cube that has pictures or patterns instead of colors for each face, then you may need to still orient the centers. This explains how to do that.

< Step 5 | Solution Outline | Go back to enjoying the rest of the website >

User Comments

livn2serv says...	This was very helpful in learning how to solve the 3x3 rubik's cube. but how do you solve a 4x4 rubi...

See full comments/Add a comment

8 Summer 6:3
10.2.30

Solving Centers of Patterned Cubes

Author: Blake

Solving Centers of Patterned Rubik's Cubes

If you have a cube where the stickers aren't just solid colors, but patterns, then you may have noticed that after solving the cube, the centers don't always orient themselves properly. This minor detail isn't covered in most Rubik's Cube solutions since everyone assumes you have a color cube. How unthoughtful.

Methodology Reasoning

Suppose you have a solved cube sans oriented centers. To rotate the center of one face in a trivial fashion, all you have to do is rotate that face. POOF. The center is rotated. However, now you have the 8 pieces around it in the wrong place. To put those pieces back, you have to undo the move you just made. It seems that you can only have one or the other.

Now, suppose you did your quarter turn to fix the center of the cube. Then, before returning the 8 pieces around it, you switched that center piece with another center, and then undid your first move. Then you returned the original centers to their initial position. You have turned a center, and then unturned a DIFFERENT center. That center and the surrounding edges are now all solved.

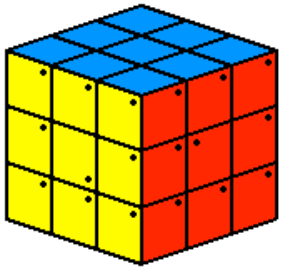
What are you talking about?

Ok, practice the following...

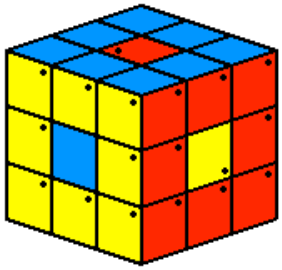
- Move the middle row of the cube in a direction.
- Now move a different middle row of the cube in a direction.
- Now undo your first move.
- Now undo your second move.

Now all the centers should be misplaced. Practice this. Practice this until you can predict where the centers will go when you perform this move.

Suppose you have the following set up where the yellow and red center are orientation dependent and must each be rotated 90 degrees.

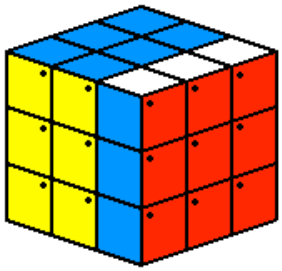


Now shuffle the centers to emulate this:

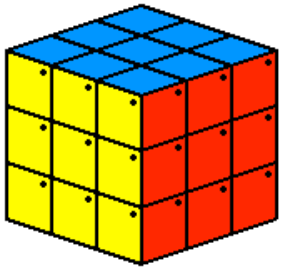


Now rotate the yellow center (and by "yellow" I mean the center on your cube that corresponds to yellow here) 90 degrees in such a way that it "fixes" it relative to the yellow face.

Yeah, like that.



Now undo the shuffling you did in the first step. Since you rotated the surrounding 8 red pieces, then when the red center returns to the red face, it is correctly oriented...usually.



Yay!

Note: This illustrates how to solve the most trivial case where two faces need to be rotated 90 degrees. Typically, several faces will need to be rotated. You can use this move several times in a row. If, for example, you have 3 centers that must be rotated 90 degrees, then you could use this move once to fix one of them, and then use this move a second time to fix the other two.

User Comments

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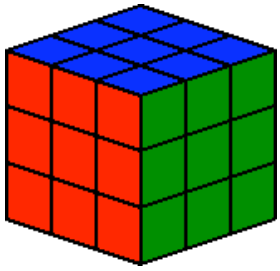
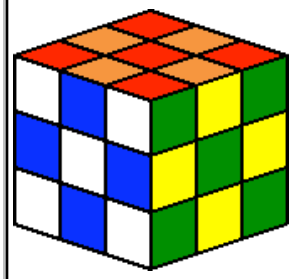
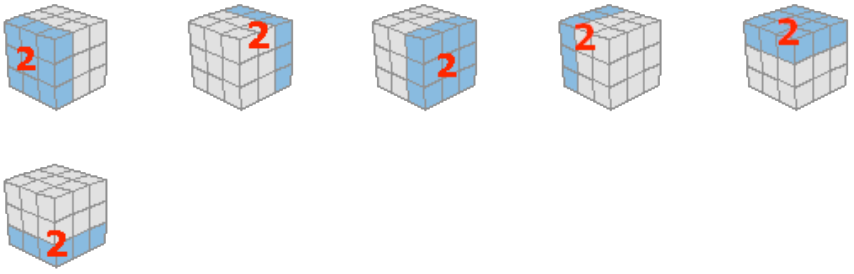
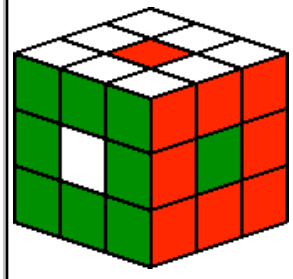
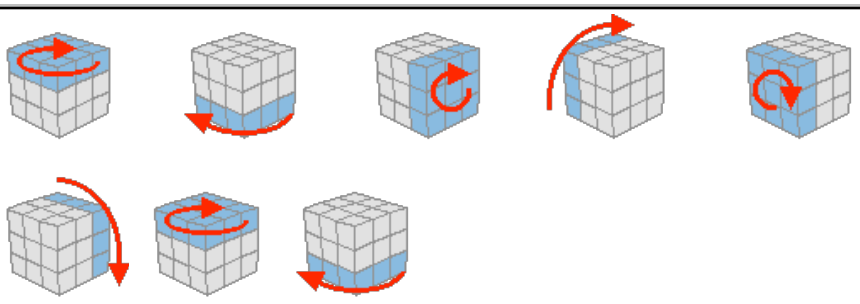
Making Patterns

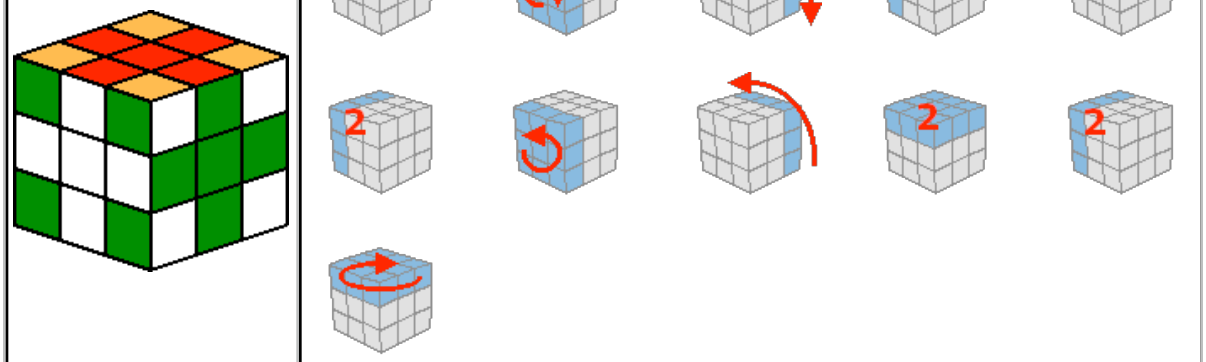
Author: Gaz

All these Rubik's Cube patterns require you to start with the cube solved.

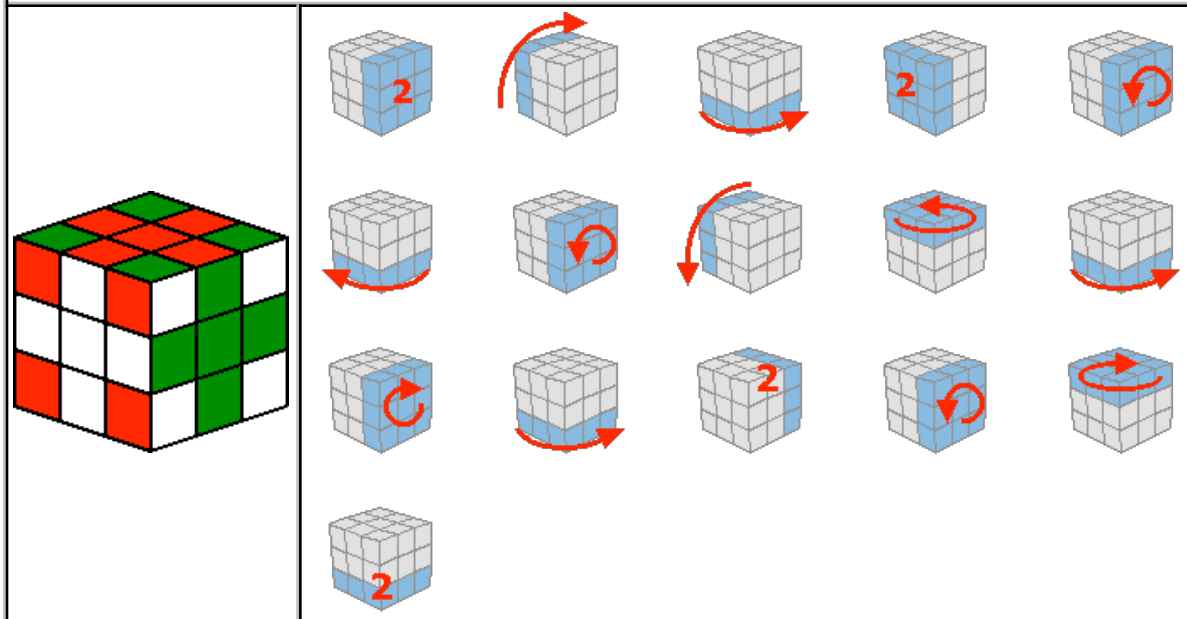


Checkerboard Pattern	
	
Six spots	
	

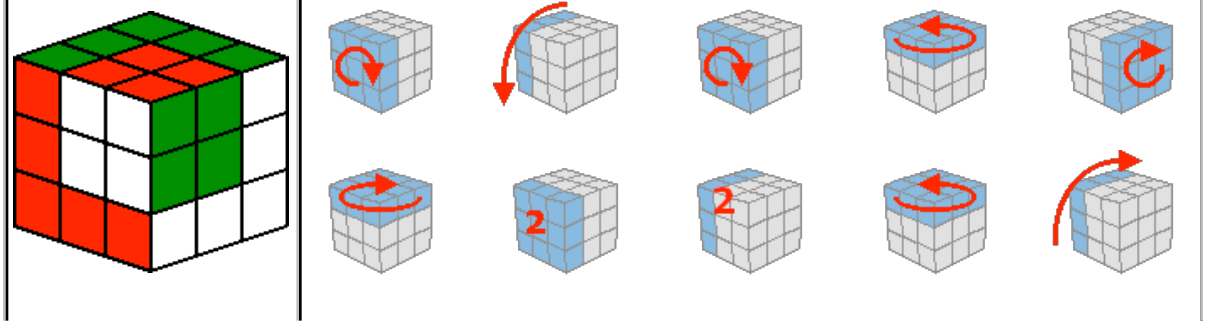
Cross (Orientation 1)

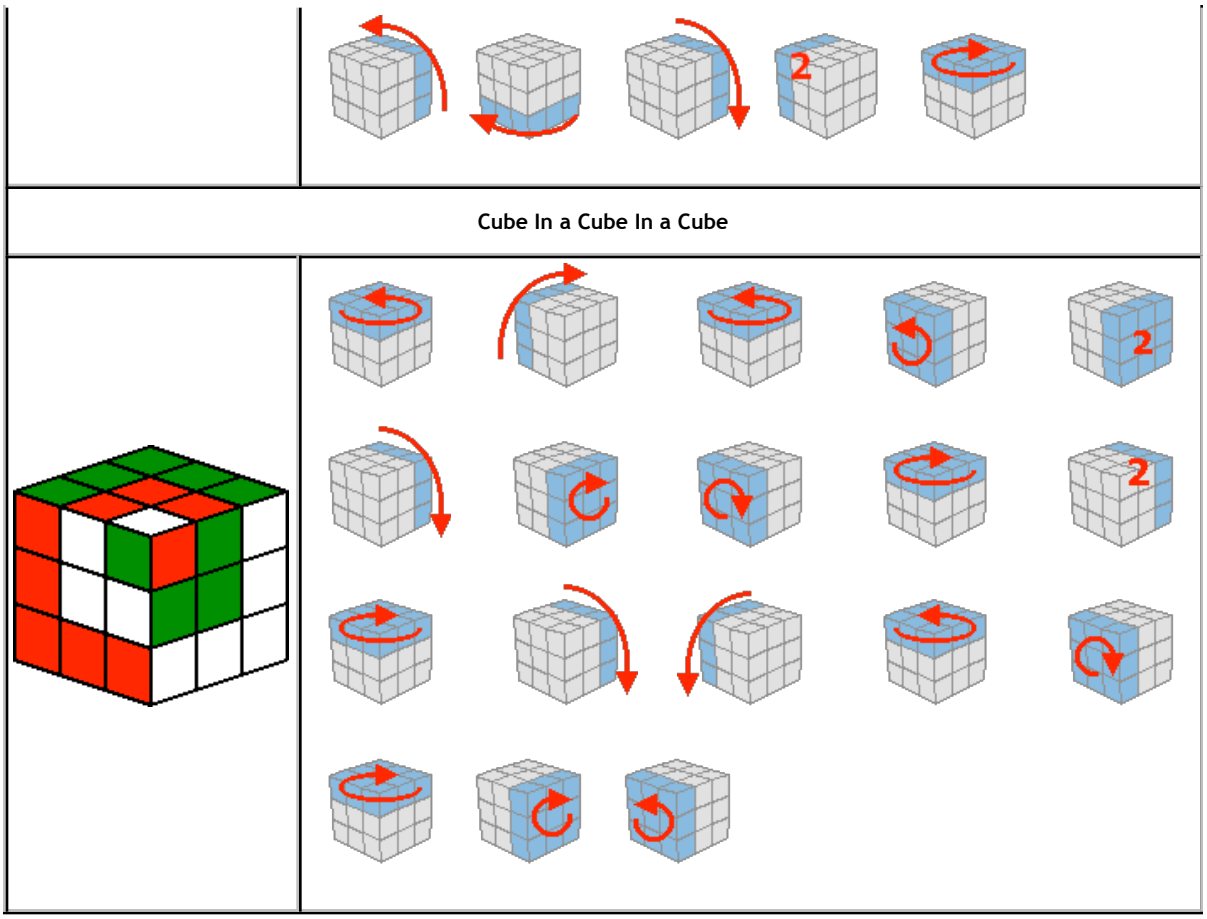


Cross (Orientation 2)



Cube In a Cube





User Comments

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8 Summer 6:3
10.6.25

Theory: Writing a 3 Piece Shuffle

Author: Blake

Hold a solved cube in front of you.

All the pieces are correct.

Move one side a quarter twist.

Now some of the pieces are not correct. Eight to be exact.

Turn another side. It doesn't matter which one. It doesn't matter which direction. It doesn't matter if it's a double twist either. Just turn one more side.

Now undo your very first move.

There are still exactly eight pieces that are incorrect.

I could prove to you why this is always the case. But you can take my word for it. This information isn't of much practical value, but it does show one thing: the cube has many mathematical constraints. Rarely can anything about a Rubik's Cube be described as "random".

When I learned how to solve a Rubik's Cube, I memorized sequences moves. Each move was a tool I kept in a mental toolbox. Each tool has a specified function and was used in a specific situation. When the situation arises, I pull out the tool and use it with full confidence that it will do what I intend it to do without questioning how it works or how it was invented. When you begin solving a cube, tools aren't very necessary. So many pieces are in the wrong place, many of which you won't care about until you're nearly done solving the cube so you have so much room to work with. The opening of your solve is easy. Many people can solve one side of a cube, because it's a small task of simply moving pieces out of the way temporarily to put other pieces in place. Some people can continue on and solve two rows, because they have that precious bottom row to use as "fudge room" to position the other pieces. But after that, almost everyone looks towards move sequences as their only tool for solving any further. Rubik's Cube move sequences can be created by a computer program with some sort of search algorithm, but that's no fun. Nor do you learn anything from that.

Hold a solved cube in front of you again.

We are now going to derive the algorithm to shuffle 3 corners.

Move the top once. It doesn't matter which direction. Just move it.

Eight pieces are now wrong. How do we fix this? Well, we just move it back. This is trivial and obvious.

One move can be undone by moving that same face in the opposite direction.

Now here's a very short sequence of moves that you're probably very familiar with.

- Turn the right side counterclockwise.
- Turn the bottom clockwise.
- Turn the right side clockwise.

Suppose you were solving the top row in a traditional manner and there was a corner piece in the FRD position with the top color's sticker facing left. Then you would use this move to put that corner into place on the top row because it does not disrupt anything else on the top row other than that one corner.

This is a handy move, extremely short, and something you were probably using all the time already.

Because you had a solved cube before you made these 3 moves, then the top row should still be entirely solved, except for the one corner in the front-right. The piece that goes in that position is now on the bottom row. Somewhere. There is also some random piece in that corner's place. What if wanted to solve the cube again? That's obvious. We just do the same 3 moves except backwards.

- Right counterclockwise.
- Bottom counterclockwise.
- Right clockwise.

These are the same three moves, except in the opposite order and in the opposite direction. Just like how we reversed one move earlier.

Do these same three moves again and then undo them. Do that over and over. Just to get a feel for it.

Watch the pieces as you do this. Eight wrong. Eight correct. Eight wrong. Eight correct.

Now do just one move. Now undo it. Do that over and over. Eight wrong. Eight correct. Eight wrong. Eight correct.

No, I'm not crazy. Bear with me. This is where the fun comes in.

Cosider this:

- **Do the three move sequence outlined above.**

  There are eight wrong pieces, but only ONE is in the top row. This move will stick that random wrong piece in the top row and moves the correct one somewhere to the bottom.

- **Turn the top in a random direction.**

  You now rotated the the top. Instead of adding 8 wrong pieces, you've only added 7 because one was already wrong. Furthermore, the wrong piece that was in the top row is now in a different wrong place, and a DIFFERENT top row piece is now in the line of fire for...

- **Undo the three move sequence.**

  Ordinarily, this would simply restore the cube by moving the wrong piece in the top row to its original position, and move the top row piece on that bottom back to its original position on the top. But now, there's a different piece in FRT. This different top-row piece goes to FLD and the top-row piece on the bottom now goes to the top row, but in a different slot.

- **Undo the random move you did to the top.**

  Now the rest of the top row (aside from those 2 corners) returns to its original state.

Congratulations. You have just seen the theory behind a 3 corner shuffle.

Many 3 piece shuffle algorithms (for both edge and corners) fall into this formula...

- Move around the cube such that two of the pieces you want to shuffle are on one side and the third piece you want to shuffle is on the opposite side. Let's call these sides side A and side B respectively.
- Move the piece from side B to where one of the pieces from side A was. However, move it in such a way that this was the only piece that is disrupted on side A.
- Twist side A such that the currently undisturbed piece is now in the location of the "bumped" piece.
- Undo your first sequence of moves
- Undo your single twist

These three pieces, whether they are edges or corners, are now shuffled. Using a little preplanning, you can use this to completely control the orientation and the direction of the shuffling.

This also isn't just handy for permuting three corners and edges, but also for orienting them too. Remember how I said the cube is mathematically constrained? It is impossible for one corner to be oriented incorrectly. It is also impossible for one edge to be oriented incorrectly. There always must be at least two. When you're down to the last 3 edge pieces or the last 3 corner pieces to solve, when you transfer one piece from one side to the other before you make switch it with another piece, if you bump a piece that's already oriented correctly, and if your transferred piece is placed correctly, then you can automatically assume the final piece will also be correctly oriented. This is the basis of 3-corner orientation algorithms or 2-edge orientation algorithms. You break the positioning of the 3 corners or two edges and then you restore them, but in a different and controlled way, such that the orientation fixes itself upon resetting them.

User Comments

imperator2 says... For months I had been trying to use the internet to find someone who had a tutorial on how to solve ...

See full comments/Add a comment

8 Summer 6:3
10.6.93

 Part 1: Singmaster Notation

 Part 2: Orientation

 Part 3: Permutations

 Part 4: Memorization Tips

Part 1: Singmaster Notation

Author: Eidolon

Ok, so we'll assume you know how to solve a rubik's cube. I just realized that the notation used on NP is...nonstandard. So, I'm going to first teach you singmaster notation.

There are 6 faces on a rubik's cube. They are Up, Down, Left, Right, Front, and Back. Each signified by its first letter (U, D, L, R, F, B).

A letter on its own signifies to turn that face 90 degrees clockwise.
So R would mean you would turn the right face ninety degrees in a clockwise manner. You got me?

A letter followed by an apostrophe (some sites use a - or an i) means to turn the face 90 degrees COUNTER clockwise.
Following that logic, L' Means to turn the left face 90 degrees CCW.

Finally, a 2 after the letter means to turn that face 180 degrees, in either direction. Some people write e.g. R2' when describing their algorithms (algs), but that's only to show their preference between performing the turn clockwise or counterclockwise.

Two tips for you:

When I was learning this notation, I used to screw up on B turns. Remember, CW/CCW are relative to when you're looking DIRECTLY AT the face. So looking from the front, B seems to be turned the wrong way.

Also, D gave me a problem at first. Just remember that a D moves the bottom row to the right, a D' moves it to the left.

A few more things:

What would cubing be without slice moves?
The three slices are M, E, and S. You won't need S for this, I just thought you might want to know.

M is the vertical, front to back slice. An M turn brings that slice down in the front, so M turns are in the same direction as L turns.

E is the horizontal, front to back slice. (think equator) E turns are made in the same direction as D, so E is to the right, E' is to the left.

S, just for your information, is the third slice. S turns are done in the same direction as F.

(I think M, E, and S stand for "meridian," "equator," and ..."sandwich," respectively, but I'm not sure. Sounds kinda shady to me)

Congratulations, you now know most of cube notation.

Piece naming:

Corners are named by naming the three faces that they intersect. The top front left corner, then, would be called UFL. Some notations differentiate between UFL and FUL, but my solution doesn't require that, so don't worry.

Edges are named similarly, by the two faces they contain. The bottom front edge would be DF. Get it?

In this blindfolded solution, I number each piece. That makes it easier for me to solve it quickly.

Corners:

1. **UFL**
2. **UFR**
3. **UBR**
4. **UBL**
5. **DFL**
6. **DFR**
7. **DBR**
8. **DBL**

Edges:

1. **UF**
2. **UR**
3. **UB**
4. **UL**
5. **LF**
6. **RF**
7. **RB**
8. **LB**
9. **DF**
10. **DR**
11. **DB**
12. **DL**

CCW circles, starting from the front/front left, going layer by layer top to bottom. Not too tough to remember.

FINALLY, YOU CAN LEARN TO SOLVE BLINDFOLDED.

...tomorrow.

User Comments

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8 Summer 6:3
10.11.92

Part 2: Orientation

Author: Eidolon

Memorizing Orientation

Ok, there are four steps to solving a Rubik's Cube blindfolded. They are, in order of solving, Corner Orientation, Edge Orientation, Corner Permutation, and Edge Permutation (orientation is the flip or twist of a piece, permutation is the location of it).

From now on we're going to assume you have the same color scheme as me (red opp. orange, white opp. yellow, blue opp. green, BOY clockwise on one corner). We'll also assume you are holding your cube the same way I am, white on top, red on front, blue on right. If this is not the case for you, you'll have to mentally translate the colors I tell you mentally. Tough luck.

So, you're looking at a scrambled cube. How do you know which pieces are oriented correctly? The answer is simple.

Corners:

Each corner can have one of three orientations. Correct (remembered by 0), Needs to be turned clockwise 120 degrees (remembered by 1), Needs to be turned CCW 120 degrees (remembered by 2) If a corner is correct, yellow or white will be either up or down. So if a corner is on the up face, the white or yellow sticker must be facing up for it to be correct. If it's on the D face, the white/yellow sticker must be facing down.

Edges:

These are a bit tougher. There are 4 rules.

1. If an edge has a yellow/white sticker, and the piece is in the U or D slice, the yellow/white sticker must be facing up/down, otherwise the piece is wrong.
2. If an edge has a yellow/white sticker, but is in the E slice, the yellow/white sticker must NOT be on the right/left face.
3. If an edge does not have a Y/W sticker, and is in the U/D slice, the blue/green sticker must NOT be facing up/down.
4. If an edge does not have a Y/W sticker, and is in the E slice, the blue/green sticker MUST be on the right/left face.

So, basically, no blue or green on the up face, and it has to be in left or right if possible. No Yellow or white in the right/left face, and it has to be up or down if possible.

It's up to YOU to remember how these orientations are to be remembered, which corners need twisting, and which edges need flipping. I'll give tips on MY system at a later date.

Solving Orientation.

So, now, you've got the orientation of your cube memorized. Now you just need to learn how to solve them. Now, there are three algorithms you need to learn:

Edge Flip: M U M U M U2 M' U M' U M' U2

This one flips the UF edge (1) and the UB edge (3).

Clockwise Corner Twist: R U R' U' R U R' U' D U R U' R' U R U' R' D'

(I remember it this way: **(R U R' U')x2 D (U R U' R')x2 D')**

This move will rotate the DFR corner (6) Clockwise (hence Clockwise Corner Twist) and the DFL corner (5) counterclockwise.

Counter-Clockwise Corner Twist: U R U' R' U R U' R' D R U R' U' R U R' U' D'

(Again, I remember this: **(U R U' R')x2 D (R U R' U')x2 D'**

This move rotates DFR Counter-Clockwise and DFL Clockwise (the opposite directions of a Clockwise Twist).

Ok, have you driven those three moves into your head? They're actually kinda useful for speedsolving too, so if you haven't learned them yet, you might want to.

The next step is to use those moves to actually solve the cube. I would suggest practicing with your eyes open first.

Edges:

First, orient the edges. You will be using what are called "setup moves" to move each edge that needs to be oriented to the 3 slot (UB). The only restriction for this is that you cannot move the UF edge out of its slot. So, the basic concept is to go through each edge that needs to be flipped (and only the ones that need to be flipped) and set them up to 3. You'll set one up, do the Edge Flip move, and then undo the setup. Note that you will not solve the UF edge. If all goes as planned, it will be solved at the end. The reason for this is that there must be an even number of misoriented edges on the cube. If the UF edge is misoriented at the start, there will be an odd number of edge flips done, and the UF edge will end up oriented. If it is already oriented at the start, there will be an even number of flips done, and it will end up misoriented.

Now, I advocate figuring out your own setup moves, but if you need help with one, or if you are a masochist and want to memorize 22 moves (there 3 more sets of setups, ultimately totaling 80, so choose carefully).
You'll also need to undo these moves, so I've put the inverses in brackets after each setup.

1. **Not Used**
2. **R B [B' R']**
3. **None (already in place)**
4. **L' B' [B L]**

5. **L2 B' [B L2]**
6. **R2 B [B R2]**
7. **B [B']**
8. **B' [B]**
9. **D2 B2 [B2 D2]**
10. **D B2 [B2 D']**
11. **B2 [B2]**
12. **D' B2 [B2 D]**

If you try, you can see a pattern with the inverses. Reverse the sequential order of the moves, and swap all clockwise for counterclockwise turns. "2" turns do not change direction. You should learn that, because I won't give you the inverses for the rest of my moves. Practice orienting your edges, first looking at it, going piece by piece, then later, by memorizing and solving only the orientation.

Corners:

The next step is to orient the corners. Again, you will make use of setups to solve, but these are different. Now you will be setting up the piece to solve into the DRF slot, performing either a clockwise or counterclockwise twist, then undoing the setup moves. In this case, you will be ignoring the 5 corner. Again, if you did it right, the 5 corner will solve itself. I myself still memorize the 5th corner and the 1st edge, just as a checksum. The corner orientation's sum must be divisible by 3. If the number you memorized for the corner was 1, you do a Clockwise Corner Twist. If it was 2, you do a Counter-Clockwise Corner Twist. If it was 0, you can just skip that corner. Don't even set it up.

The corner setups similarly have only one limitation: do not disturb the DFL corner (5). Here are mine:

1. **1: U' R'**
2. **R'**
3. **U R'**
4. **U2 R'**
5. **Not Used**
6. **None (already in place)**
7. **R**
8. **B R**

I'll let you figure out how to invert these. Tell me if you really don't get it, and need help.

Again, practice. First, just orient your corners while looking. Then, close your eyes. Then start doing edges AND corners. If you can get that, CONGRATULATIONS. You're halfway there.

User Comments

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8 Summer 6:3
10.12.32

Part 3: Permutations

Author: Eidolon

Memorizing Permutation.

So, your cube is fully oriented. Any non-cuber looking at it would say "hey, it's kidnasorta almost there".

BUUUUUUUUUT you're not. All the pieces are flipped the right way, but they're not all in the right place. And this is the harder step.

You solve permutation (the location of the pieces) with cycles. Basically, you start with a Buffer piece (2 in both corners and edges). Look which piece is in that location. Then look at where that piece goes. Let me start with corners.

So, your "buffer" corner is UFR (2). You look at (visit) 2, and see which piece is there. say, for example, it is the piece that belongs in 6. You will then look to 6, and see which piece is there. That one, we'll say, belongs in 4. So you look at 4, and so on, until every unsolved corner has been visited.

There are two problems you may run into. One, you may run into the 2 piece before you're finished. There is a simple solution to this. Instead of checking the 2 slot again, check another slot that hasn't been checked yet (if all the slots have been checked, then you're done). Say you find the 2 piece, and choose to check 4 as your other slot. Now you will keep going until you run into 4 again. If you run into 4 again, you may need to start ANOTHER new cycle AFTER visiting 4 for a second time. You don't visit 2 again, but any location you chose after running into the 2 piece is visited twice. If there are no more unvisited corners, you've finished your corner memorization.

The other problem is parity. Basically, my answer to parity is this: If you have an odd number of corners visited, add a 3 to the end of your cycles. Another mathematical limitation of the cube is that the whole thing must have an even permutation. Basically, between corners and edges, you must have an even number of pieces swapped. So if corners are odd, edges must also be odd, and vice versa.

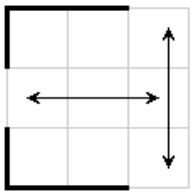
Then, edges. Edges use the EXACT same principle. Look to UR (2) for the first piece to pick. Go through and visit every unsolved edge, from location to location the same way as with corners. The only difference is, you don't have to worry about parity with edges. You might want to count the total numbers just to make sure, though. Another checksum, if you're not sure.

Solving Permutation.

Both corner and edge permutation is solved with the same algorithm, the "T perm".

T perm: R U R' U' R' F R2 U' R' U' R U R' F'

This swaps Corners 2 and 3 and edges 2 and 4 (it makes a T shape, if you draw out the arrows of what's swapped).



Get used to that one too, it's very good for speedcubing.

So, for corners, you will set up each numbered piece in order to the 3 slot, UBR. These setups ARE a bit harder than the orientation setups, because they have to keep the piece oriented, and they can't disturb the UR and UL EDGES (2 and 4), OR the UFR corner (2). You'll setup a corner, do a T perm, and undo the corner. Here are my setups for corners. Again, you'll have to figure out the inverses yourself. You can ask me if you're stumped, but it's more useful for you to figure them out.

Corner Setups:

1. **L2 B2 L2**
2. **Not Used**
3. **None (already in place)**
4. **B2 D B2**
5. **D' B2**
6. **D2 B2**
7. **D B2**
8. **B2**

Again, as before, practice. First with your eyes open, then memorize and do it closed. Don't be afraid to peek while practicing, but it's not as impressive to your friends (or allowed in official competitions).

Edges, again, are similar. You can't disturb corners 2 and 3, or edge 2. You will be setting up your edges to 4. Setup, T perm, Undo setup.

Edge Setups:

1. **M2 D L2**
2. **Not Used**
3. **M2 D' L2**
4. **None (already in place)**
5. **L'**
6. **E2 L**

7. **E2 L'**
8. **L**
9. **D' L2**
10. **D2 L2**
11. **D L2**
12. **L2**

Practice, eyes open, eyes closed, peeking allowed, etc. I know, you stopped reading already. After this, you know everything you need to solve a cube blindfolded. The next installment is just going to be my tips for memorization.

User Comments

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