The Professor's Cube

I. Solve the Top Center Face

Welcome to the Professor's Cube solution, the is the Grand-daddy of 'em all. There are 92 pieces you have to solve:

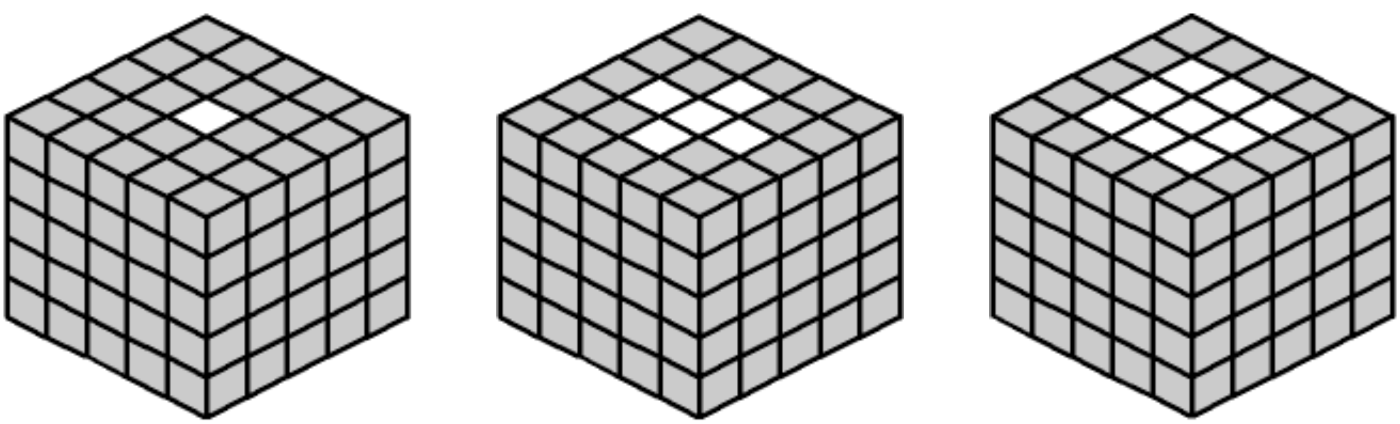
- 8 corners
- 24 outer edges
- 12 inner edges
- 24 outer faces
- 24 inner faces

The 6 center faces are fixed, and they define what color each side will eventually become. They can rotate in place, but can never jump from face to face.

Q: Is my brain going to explode?

A: No. Most of the moves used for this solution should already be familiar to you; the notation may be somewhat different (due to the extra slices and layers), but you should recognise the same *feel* of it. For example, the method for solving all corners is identical to the moves found in the Rubik's Cube and Revenge solution. With exception, the outer-edges follow the same method as the 4x4x4 solution, while the inner-edges mirror the 3x3x3. Some of the moves have been modified for reasons I will explain later. Basically, all you are doing is solving a Regular and Revenge cube at the same time.

Anyway, let's get on with the top faces...

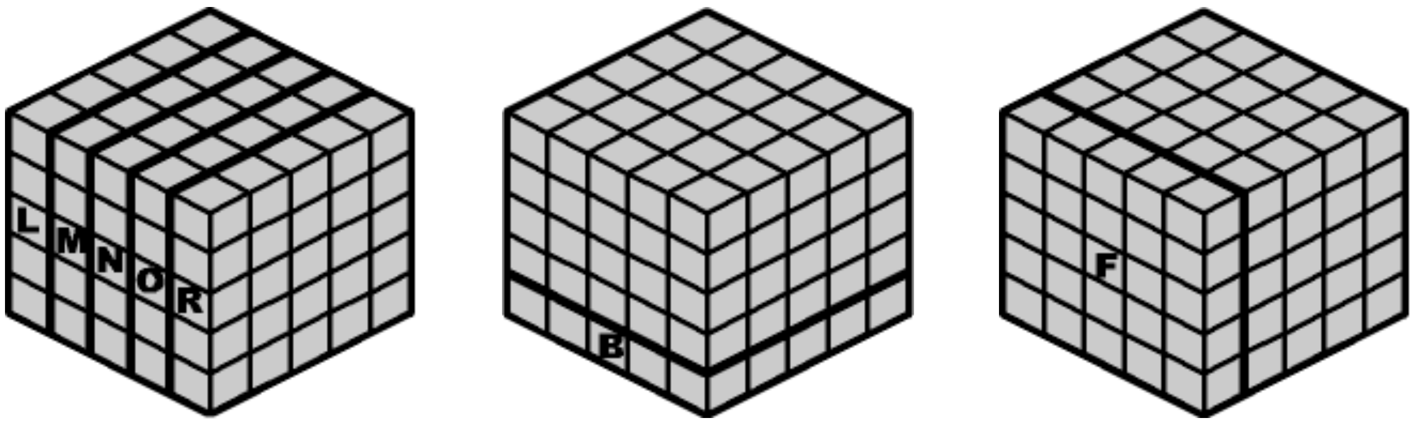


Pick a favorite color as the top side. **Solve the top inner-faces first** **Solve the top outer-faces last**

I am not going to decribe how to do this, as this should be intuitive and easy enough for anyone to do. However, you must choose what the top side is, and which color to use. After that, *the top side stays on top for the rest of the solution.*

Note: It is not necessary to solve all 4 inner faces before solving the next 4 outer-faces. You can solve the 8 pieces in any order you please. Yet, the easiest way is to follow the diagrams.

Notation:



There are fifteen layers in the Professor's Cube, but we only need to concern ourselves with **seven** of them; the five vertical slices **(Left, M, N, O and Right),** the bottom layer **(B)** and the front side **(F).**

- **L+** ...move the LEFT slice UP (1/4 turn)
- **L-** ...move the LEFT slice DOWN (1/4 turn)

- **M+** ...move the 'M' slice UP (1/4 turn)
- **M-** ...move the 'M' slice DOWN (1/4 turn)

- **N+** ...move the 'N' slice UP (1/4 turn)
- **N-** ...move the 'N' slice DOWN (1/4 turn)

- **O+** ...move the 'O' slice UP (1/4 turn)
- **O-** ...move the 'O' slice DOWN (1/4 turn)

- **R+** ...move the RIGHT slice UP (1/4 turn)
- **R-** ...move the RIGHT slice DOWN (1/4 turn)

- **[MNO]+** ...move the middle three vertical slices (M,N&O) UP
- **[MNO]-** ...move the middle three vertical slices (M,N&O) DOWN

- **B+** ...move the BOTTOM layer RIGHT (1/4 turn)
- **B2** ...move the BOTTOM layer HALF-WAY AROUND (1/2 turn)
- **B-** ...move the BOTTOM layer LEFT (1/4 turn)

- **F+** ...move the FRONT side CLOCKWISE (1/4 turn)
- **F2** ...move the FRONT side HALF-WAY AROUND (1/2 turn)
- **F-** ...move the FRONT side COUNTER-CLOCKWISE (1/4 turn)

NEXT: Solve the **Top Corners...**

@ Notation / Top Face
@ Top Corners **@ Top Outer-Edges** **@ Top Inner-Edges**
@ Middle Outer-Edges **@ Middle Inner-Edges**
@ Bottom Corners **@ Bottom Outer-Edges** **@ Bottom Inner-Edges**
@ Middle & Bottom Faces

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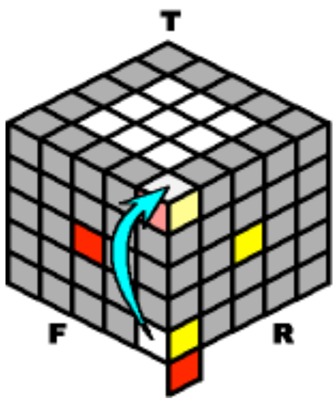
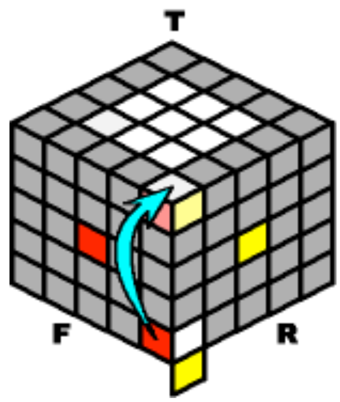
II. Solve the Top Corners

Below are 3 ways to get a corner piece from the bottom to the top. Because a corner can be rotated 3 different ways, there are 3 different sequences to get the corner piece arranged correctly. Before attempting any of these moves, you must rotate the bottom layer until the desired corner piece is directly below its destination.

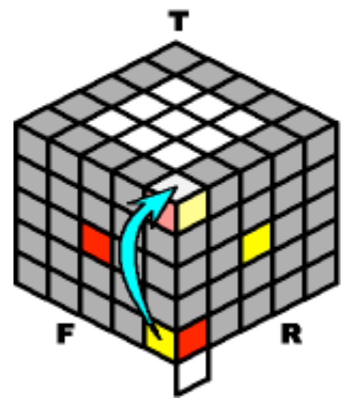
~~~~ Move Up: ~~~~



F+ B+ F-



R- B- R+

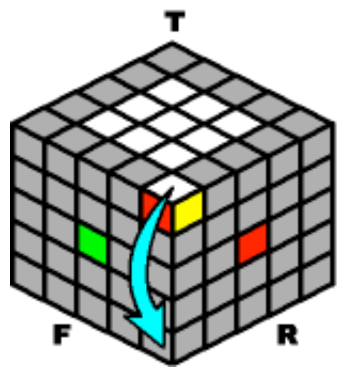


**R2 B-
R2 B+ R2**

Oops! Did you MOVE UP this corner piece the wrong way? Don't panic... you can either KNOCK DOWN this piece, and start it over again; or merely ROTATE that same piece in its place later on.

Sometimes, a corner piece is already in the top layer, but on the wrong corner. Use the simple sequence below to knock it down to the bottom layer. Afterwards, you can climb it up to its correct spot by using one the previous sequences.

~~~~ Knock Down:~~~~

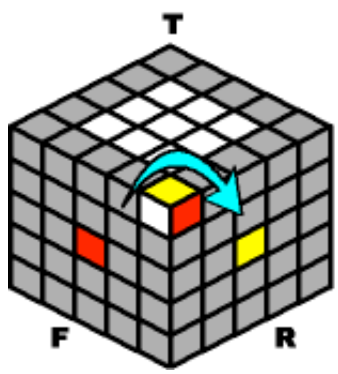


R- B- R+

Other times, a top corner piece is in the right spot, but rotated wrong. So...

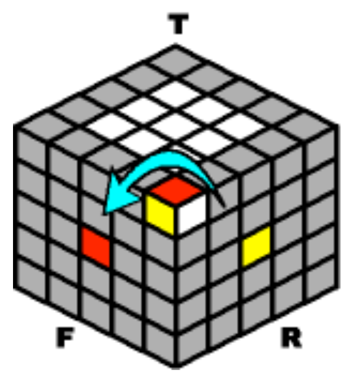
~~~~ Rotate ~~~~

Clockwise:



R- B+ R+
F+ B+ F-

Counter-Clockwise:



F+ B- F-
R- B- R+

You only need to memorize **one** of the above. For example, if you choose to memorize the "clockwise" sequence, then use it **twice** to rotate a corner piece counter-clockwise.

Go ahead and solve the other top corners. You will not disturb any of the others that are already fixed in place. As a matter of fact, you will not disturb *any* cubelet on the top face, whether it is solved or not. Now you can proceed to solve the
Top Outer-Edges.

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges

@ Middle Outer-Edges **@ Middle Inner-Edges**
@ Bottom Corners **@ Bottom Outer-Edges** **@ Bottom Inner-Edges**
@ Middle & Bottom Faces

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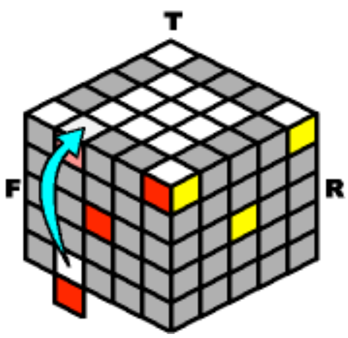
III. Solve the Top Outer Edges

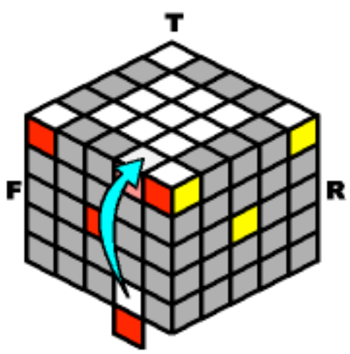
All outer-edges have a strange property; half of them are "left-handed", while the other half are "right-handed". If a left-hand edge lands on a right-hand spot (or visa-versa), it gets inverted. Otherwise, it is correctly polarized. Anyway, now that trivia time is over, let's get back to the solution...

Here are 4 ways to get an outer-edge from the bottom to the top. Rotate the bottom layer until the outer-edge appears in the front, and then get ready to climb it to the top. Make sure the color patterns match before moving a single slice.

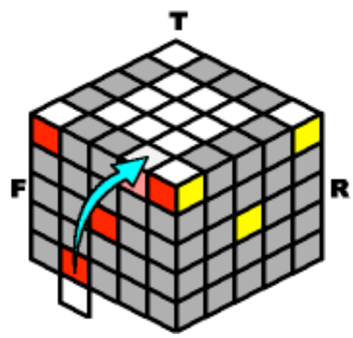
~~~~ Move Up (from the bottom): ~~~~



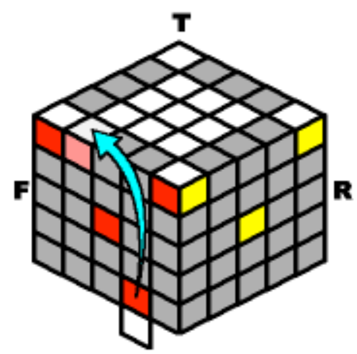
B- M- B+ M+



B+ O- B- O+



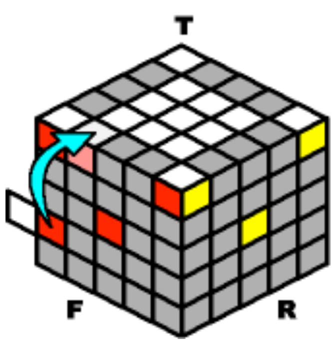
**O- B2 O+ B+
O- B- O+**



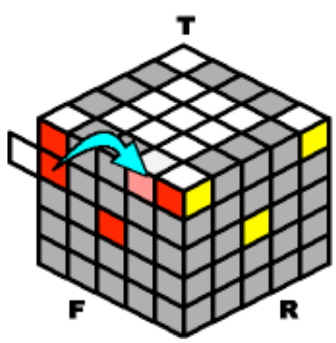
**M- B2 M+ B-
M- B+ M+**

An outer-edge can also appear at the "equator" of the puzzle. It can start from four different places, so once again there are four different moves to navigate it to the top. You may have to rotate the top layer to match the diagrams below.

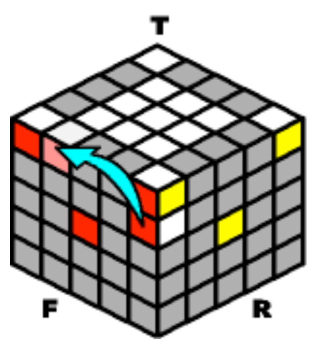
~~~~ Move Up (from the equator): ~~~~



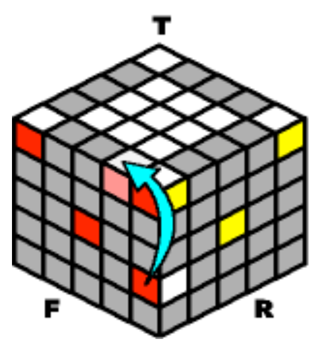
**M- B- L- B+
M+ B- L+**



**O- B- L- B+
O+ B- L+**



**M- B+ R- B-
M+ B+ R+**



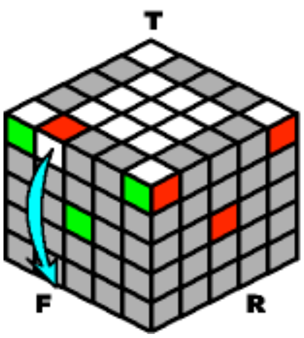
**O- B+ R- B-
O+ B+ R+**

Note: these moves are optional and are provided only as ***shortcuts****. You can bypass this section by knocking an edge down from the equator (next section), and moving it up to the top layer (previous section) afterwards. On the plus-side, you have less moves to memorize. On the minus-side, you have to do twice as much work.*

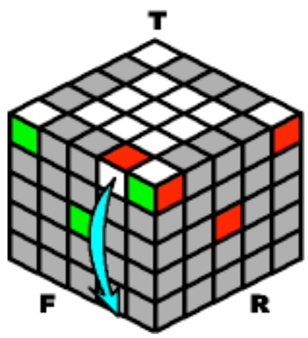
Knock Down:

The outer-edge you want to move may not always on the bottom layer. Sometimes it can appear at the equator of the puzzle; other times it can already be on the top layer, but on the wrong side. Either way it must be knocked down, so you can climb it up to the correct spot later on.

~~~~ Knock Down (from the top): ~~~~

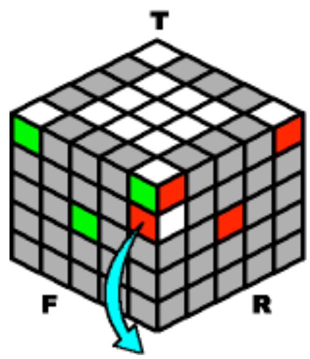


M- B- M+

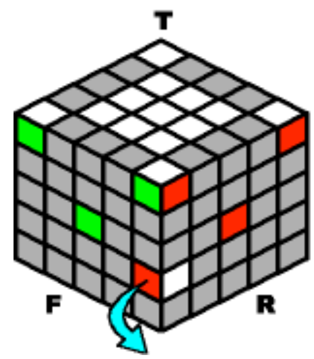


O- B+ O+

~~~~ Knock Down (from the equator): ~~~~



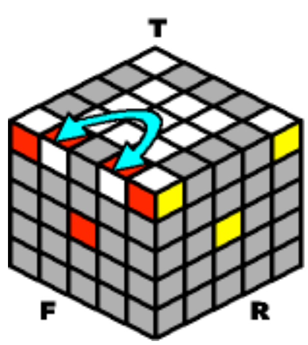
O- B- R- B+
O+ B- R+



M- B- R- B+
M+ B- R+

And finally, if you need to invert a pair of outer-edges that are already on top:

~~~~ Invert: ~~~~



M- O- B2
M+ O+ B-
M- O- B+
M+ O+

Go ahead and solve the other top outer-edges. You will not disturb any of the others that are already fixed in place. As a matter of fact, you will not disturb *any* cubelet on the top face, whether it is solved or not. Now you can proceed to solve the
[Top Inner-Edges.]

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges
@ Middle Outer-Edges @ Middle Inner-Edges
@ Bottom Corners @ Bottom Outer-Edges @ Bottom Inner-Edges
@ Middle & Bottom Faces

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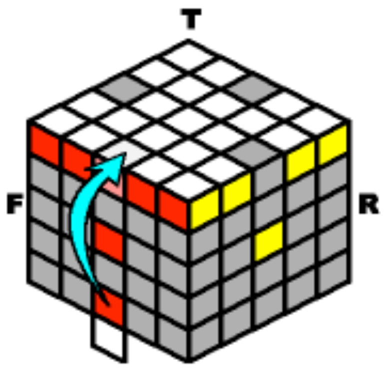
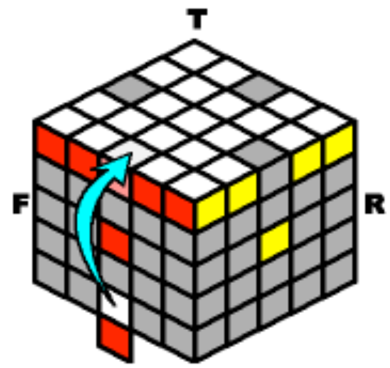
IV. Solve the Top Inner Edges

There are 4 inner-edges that have to be placed on the top layer, one at a time. If the edge is on the bottom layer, then rotate the bottom layer until that edge appears in the front, dircetly below its destination. An inner-edge can be flipped around two different ways, so there are two different moves used to climb it to the top.

~~~~ Move Up (from the bottom): ~~~~



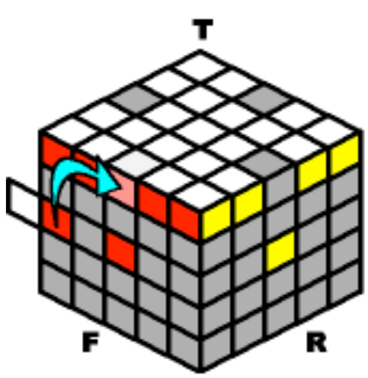
N- B2 N+



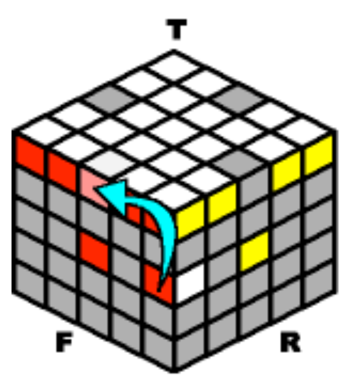
B- N- B+ N+

An inner-edge can also appear at the "equator" of the puzzle. It can start from two different places, so once again there are two different moves to navigate it to the top. You may have to rotate the top layer to match the diagrams below.

~~~~ Move Up (from the equator): ~~~~



N- B- L- B+
N+ B- L+



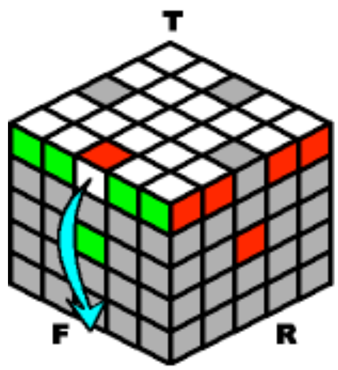
N- B+ R- B-
N+ B+ R+

Note: these moves are optional and are provided only as ***shortcuts****. You can bypass this section by knocking an edge down from the equator (next section), and moving it up to the top layer (previous section) afterwards. On the plus-side, you have less moves to memorize. On the minus-side, you have to do twice as much work.*

The inner-edge you want to move may not always on the bottom layer. Sometimes it can appear at the equator of the puzzle; other times it can already be on the top layer, but on the wrong side. Either way it must be knocked down, so you can climb it up to the correct spot later on.

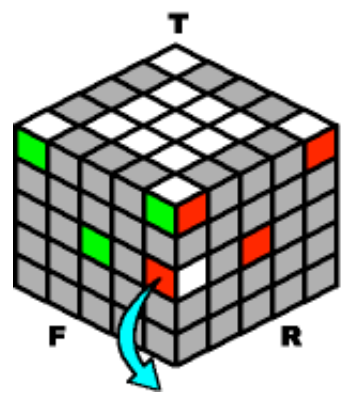
~~~~ Knock Down ~~~~

(from the top):



N- B- N+

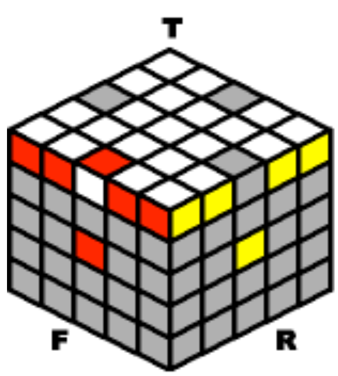
(from the equator):



N- B- R- B+
N+ B- R+

And finally, you may need to invert an inner-edge that is already in place.

~~~~ Invert: ~~~~



N- B2 N+ B-
N- B+ N+

After arranging all the top inner-edges, the entire Top Side should be completed. Congratulations! Even just solving one side is enough to stun anyone in total awe.

If you want, you can scramble the cube and re-do the top side again, as practice makes perfect. By re-solving the top layer, you become more accustomed with the Professor's Cube and the moves that solve it. It also builds up an arsenal of ammunition that conquer the later steps.

Q: Why do I have to solve the top inner-edges last?

A: You don't. You can solve the inner-edges before doing the outer-edges or even the top corners. You can even alternate (edge, corner, edge, corner, etc.) the solution steps if you want. The moves for solving the top corners and top edges were carefully selected so that they do not interfere with each other; as some prefer to finish a row of cubelets for each side. However, you MUST finish the entire top side before solving the...

Middle Outer-Edges.

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges
@ Middle Outer-Edges @ Middle Inner-Edges
@ Bottom Corners @ Bottom Outer-Edges @ Bottom Inner-Edges
@ Middle & Bottom Faces

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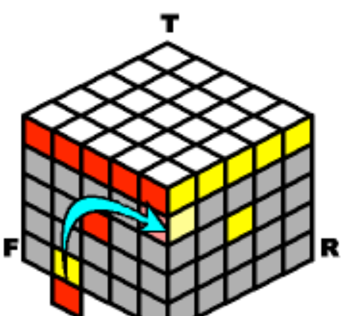
V. Solve the Middle Outer Edges

This has the same steps as the "Top Edges" section; **move** an edge from the bottom, **knock** it down or **invert** it.

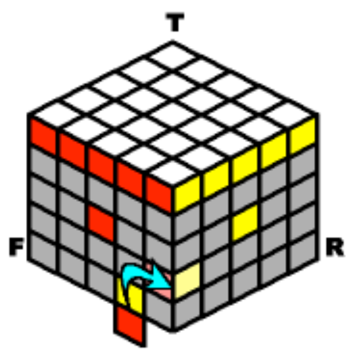
Hint: Try to finish as many outer-edge pieces as you can, by merely rotating the mid-upper and/or mid-lower horizontal layers first. You should be able to wrap up a couple of outer-edges quite easily that way. There is no guarantee, but the odds are in your favor.

Chances are, you have outer-edges on the bottom layer that need to be moved up to the equator. Rotate the bottom layer to set the edge piece in the starting position. Before doing any moves, you must make sure that the patterns are just like the diagrams below. The colors may be different, but the pattern must be the same. Notice how the edge piece (on the bottom, in the *starting* position) looks like it's mismatched with the front side.

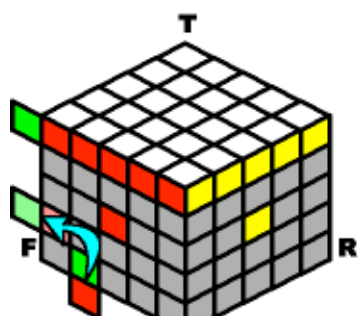
~~~~ Move Up: ~~~~



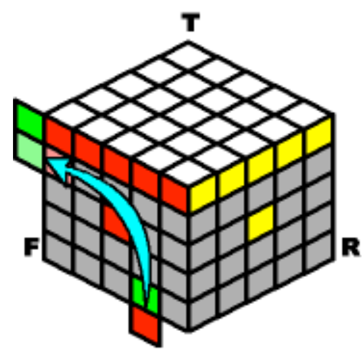
B2 O- B- R-
B+ O+ B- R+



B2 M- B- R-
B+ M+ B- R+



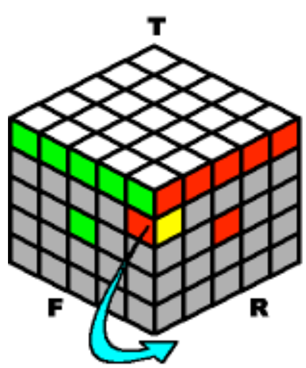
B2 O- B+ L-
B- O+ B+ L+

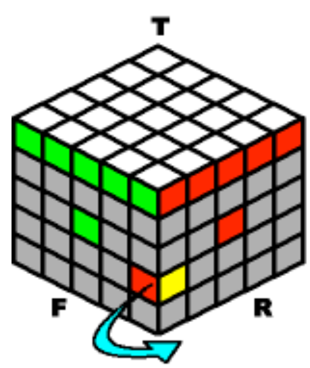


B2 M- B+ L-
B- M+ B+ L+

A middle outer-edge piece could already be in the equator, but in the wrong spot. Use the sequence below to knock it down to the bottom layer. You can move it back up to its proper place later, by using one the sequences above.

~~~~ Knock Down: ~~~~





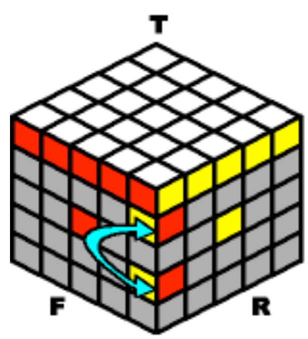
O- B- R-	**M- B- R-**
B+ O+ B- R+	**B+ M+ B- R+**

In case you haven't noticed, these sequences look very similar to the "move-up" sequences. In reality, all you are doing is moving up an edge from the bottom, which in turn knocks down the target edge from the equator.

Hint: Use the "Knock-Down" sequence only as a LAST RESORT. Almost all the time, that edge can be knocked down to the bottom layer later anyway, when you are merely doing a "Move-Up" sequence with another middle-edge piece.

And finally, to invert a pair of outer-edge pieces, already at the equator:

~~~~ Invert: ~~~~



M- B- R- B+
M+ B- R+ B-
O- B- R- B+
O+ B- R+ B-
M- B- R- B+
M+ B- R-

At 23 moves, this is one of the longest sequences used in the Professor's Cube solution. If you do not want to memorize it, then knock down the pair of edges (one at a time), and then rebuild them (one at a time) later to their correct positions, using the "move-up" and "knock-down" steps.

It may be scary at first. When solving any of the middle edges, the top side gets scrambled temporaily; but after the moves are over with the top side remains intact, along with the other middle outer-edges you just carefully put in place. Even the scrambled middle inner-edges are still where they used to be! Speaking of scrambled eggs, let's forge onto the the...

Middle Inner-Edges.

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges
@ Middle Outer-Edges @ Middle Inner-Edges
@ Bottom Corners @ Bottom Outer-Edges @ Bottom Inner-Edges
@ Middle & Bottom Faces

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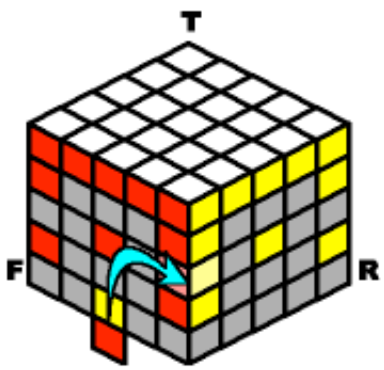
VI. Solve the Middle Inner Edges

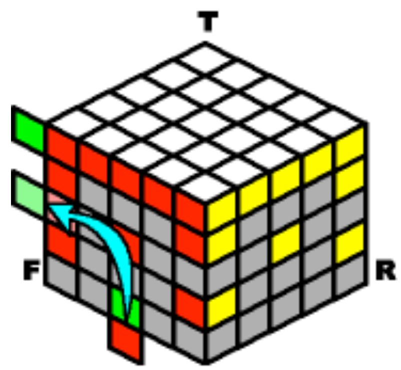
This has the same steps as the previous sections; **move** an edge from the bottom, **knock** it down or **invert** it. It may be scary at first. When solving any of the middle edges, the top side gets scrambled temporaily; but after the moves are over with the top side is intact again, with another middle edge in place to boot!

Chances are, you have inner-edges on the bottom layer that need to be moved up to the equator. Rotate the bottom layer to set the edge piece in the starting position. Before doing any moves, you must make sure that the patterns are just like the diagrams below. The colors may be different, but the pattern must be the same. Notice how the edge piece (on the bottom, in the *starting* position) looks like it's mismatched with the front side.

~~~~ Move Up: ~~~~



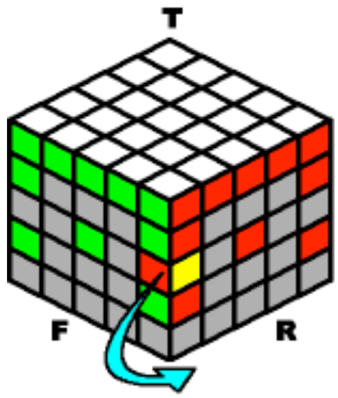
B2 N- B- R-
B+ N+ B- R+



B2 N- B+ L-
B- N+ B+ L+

A middle inner-edge piece could already be in the equator, but in the wrong spot. Use the sequence below to knock it down to the bottom layer. You can move it back to its proper place later, by using one the sequences above.

~~~~ Knock Down: ~~~~



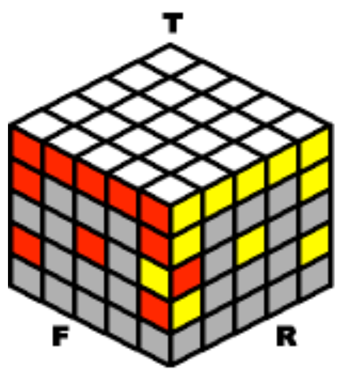
N- B- R- B+
N+ B- R+

In case you haven't noticed, this sequence looks very similar to one of the "move-up" sequences. In reality, all you are doing is moving up an edge from the bottom, which in turn knocks down the target edge from the equator.

Hint: Use the "Knock-Down" sequence only as a LAST RESORT. Almost all the time, that edge can be knocked down to the bottom layer later anyway, when you are merely doing a "Move-Up" sequence with another middle-edge piece.

A middle inner-edge piece could already be in the equator and at the correct spot, but inverted. Use this move to flip it around:

~~~~ Invert: ~~~~



N- B- R- B+
N+ B- R+ B-
N- B- R- B+
N+ B- R+

The bad news is, at 15 moves that this sequence is very long. The good news is that you don't have to memorize it! This sequence is actually a combination of the "knock-down" sequence, followed by one of the "move-up" sequences. So if you don't want to memorize this, knock down the edge from the equator (by using the "knock-down" sequence), and then turn the bottom layer until that edge appears on the bottom-front. After that, move the edge up using the proper "move-up" sequence.

Q: Why do I have to solve the inner-edges last while solving the three layers of the EQUATOR?

A: You don't. You can solve the inner-edges first before doing the outer-edges if you want. You can even alternate (inner-edge, outer-edge, etc.) the solution steps if you want. The moves for solving the middle edges do not interfere with each other; so you can choose to solve the cubelets a column at a time or even layer by layer. However, You MUST finish all the middle edges (inner & outer) before solving the...

Bottom Corners.

@ Notation / Top Face
@ Top Corners **@ Top Outer-Edges** **@ Top Inner-Edges**
@ Middle Outer-Edges **@ Middle Inner-Edges**
@ Bottom Corners **@ Bottom Outer-Edges** **@ Bottom Inner-Edges**
@ Middle & Bottom Faces

Return to Mathematica

The Professor's Cube

VII. Solve the Bottom Corners

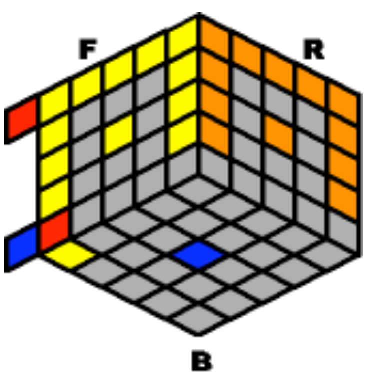
We have finally reached the bottom layer. While solving the top layer, the user was allowed to solve the corners and edges in any order. While solving the equator, the user was allowed to solve the outer and inner edges in any order. But when solving the bottom layer, that degree of freedom disappears, and the user must follow this particular order:

- Solve the 4 bottom corners FIRST
- Solve the 8 outer-edges NEXT
- Solve the 4 inner-edges NEXT
- Solve center faces LAST

By now, the remaining corners and edges are already at the bottom layer, so there are no more "move-up" or "knock-down" moves anymore. From now on, all moves will either swap pieces around or twist them in their spot. The first step is to arrange the bottom corners in the correct positions:

~~~~ Place the Bottom Front Corners ~~~~

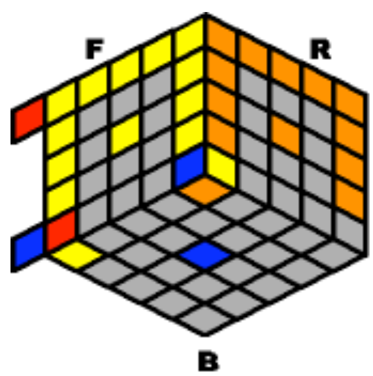
Turn the bottom layer until the lower-left front corner cube is in place

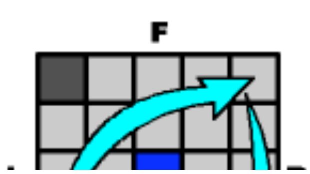


Repeat this sequence:

R- B+ L- B-
R+ B+ L+ B-

...until both lower front corners are in place.





What the move does:
It swaps the other
3 corner cubes on the

Bottom View

bottom layer clockwise.

You may have to repeat the sequence **twice** to fix the front bottom corners in place.

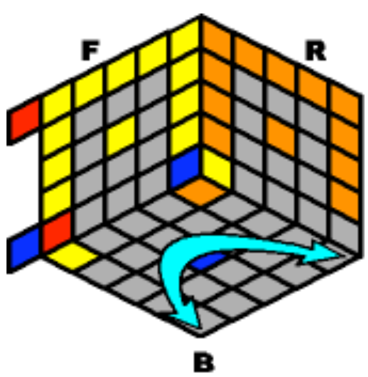
Variations:

For you experts, there are variations to the prior sequence that yield powerful results. There is no need to memorize any of these, as all the other moves give you enough ammunition to solve the cube. But if you want to save a few moves, here they are:

Sequence:	**Result:**
B- R- B+ L- B- R+ B+ L+ B2	The same 3 corners are swapped counter-clockwise.
B2 R- B+ L- B- R+ B+ L+	The (bottom) right 2 corner cubes are swapped.
B+ R- B+ L- B- R+ B+ L+ B+	The (bottom) back 2 corner cubes are swapped.

The two front (bottom corner) cubes should now be in place. The back ones may also be in place; but if they are not, **swap** them with the following move:

~~~~ Swap the Bottom Rear Corners ~~~~



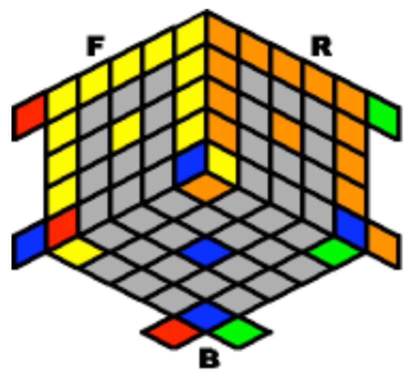
B+ R- B+ L-
B- R+ B+ L+
B+

You only have to do the sequence **once** to swap the rear bottom corners in place.

All 4 bottom corner cubes are now in place. The next step is to twist each corner so that their bottom sides are the correct color. In the worst-case scenario, **NO** corner cube has a bottom side with the correct color. In this case, do the following move:

~~~~ Finish (at least) One Corner Cube ~~~~

R- B- R+ B-
R- B2 R+ B2



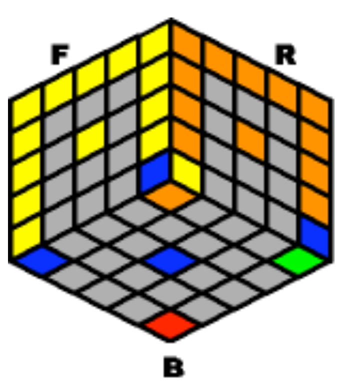
You only have to do this **once**. Now there is at least **ONE** corner cube is finished, with the right color on the bottom side.

Note: Ignore the diagram. As long as you keep the original top face on the top side, this sequence will guarantee that at least ONE bottom-corner cube will be finished afterwards.

Now it is time to finish another corner cube:

~~~~ Finish the Bottom Front Corners~~~~

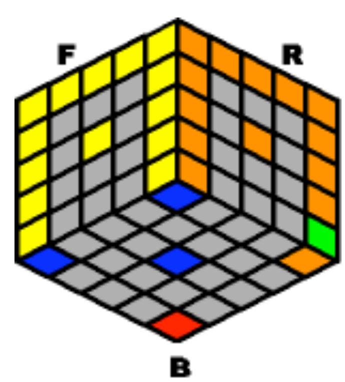
Rotate the entire puzzle so that (one of) the finished corners is in the lower-left front

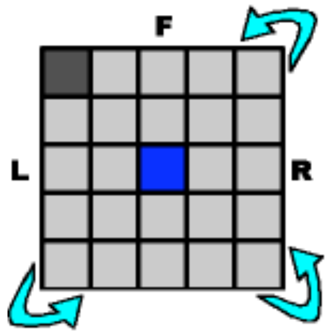


Repeat the move:

R- B- R+ B-
R- B2 R+ B2

...until both front corners are done.





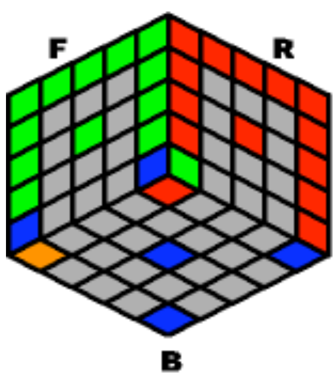
Bottom View

What the move does:
It twists each of the other 3 corner cubes counter-clockwise.

You may have to repeat the sequence **twice** to finish the front bottom corners.

The two front (bottom corner) cubes should now be finished. The back ones may also be done; but if they are not...

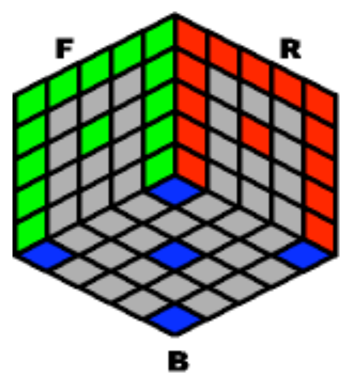
Rotate the entire puzzle so that the finished corners are in the back

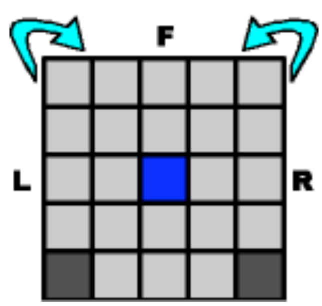


Repeat the move:

R- B- R+ B-
R- B2 R+ B2
L- B+ L+ B+
L- B2 L+ B2

...until all four corners are done.





Bottom View

What the move does:
It turns one corner clockwise, and turns the other corner cube counter-clockwise.

You may have to repeat the sequence **twice** to finish all four corners.

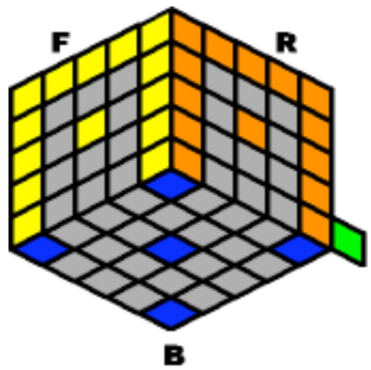
It is now time to solve the **Bottom Outer-Edges.**

@ Notation / Top Face
@ Top Corners **@ Top Outer-Edges** **@ Top Inner-Edges**
@ Middle Outer-Edges **@ Middle Inner-Edges**
@ Bottom Corners **@ Bottom Outer-Edges** **@ Bottom Inner-Edges**
@ Middle & Bottom Faces

Return to Mathematica

The Professor's Cube

VIII. Solve the Bottom Outer Edges



*Sorry to say but **hands down**, this is the most confusing part of the solution. If you can guide your way out of **this section**, then the rest will just be a walk through the park.*

The remaining 8 outer-edges are already on the bottom layer, and chances are they are pretty much scrambled. The first step is to arrange them in the correct positions. Randomly choose a front side, and proceed to solve the back edges; starting with the back-left edge first and the back-right edge second.

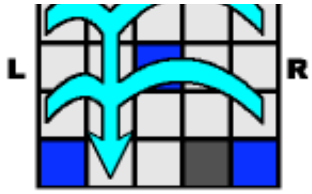
Note: these diagrams look strange. The first one appears to take 4 outer-edges and cram them into one. What the first diagram actually means is that if an outer-edge cube is coming from the left or right sides, then you must repeat the sequence until it appears in the back-left edge. You may have to repeat this sequence *four* times before that happens.

The second diagram represents any outer-edge from the front side moving to the back-left edge. You may have to repeat that squence *twice* before it lands there. The dark squares on both diagrams are edges cubes that do not move at all during the process.

Now continue to...

~~~~ Move an Outer-Edge to the Back-Left ~~~~

Move an edge from either side	**Repeat the sequence:**	**...until the edge lands on the back-left**
	**M- R- M+ R2**	**You may have to**



Bottom View

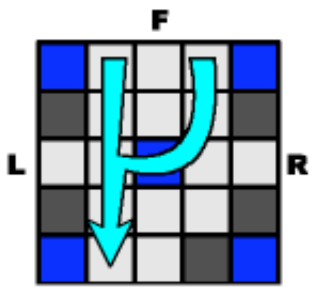
M- B- M+

repeat the sequence as many as 4 times.

Move an edge from the front

Repeat the sequence:

...until the edge lands on the back-left



Bottom View

M- B2 M+ B-
M- B- M+
O- B2 O+ B+
O- B+ O+

You may have to repeat the sequence as many as 2 times.

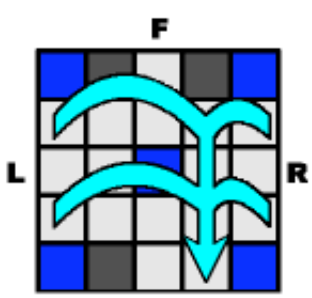
Now continue to...

~~~~ Move an Outer-Edge to the Back-Right: ~~~~

Move an edge from either side

Repeat the sequence:

...until the edge lands on the back-right

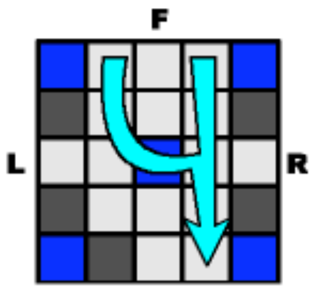


Bottom View

O- B+ O+ B2
O- B+ O+

You may have to repeat the sequence as many as 4 times.

Move an edge from the front



Bottom View

Repeat the sequence:

O- B2 O+ B+
O- B+ O+
M- B2 M+ B-
M- B- M+

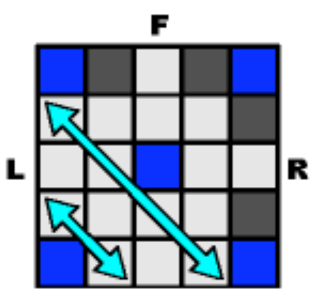
...until the edge lands on the back-right

You may have to repeat the sequence as many as 2 times.

If you are lucky, the outer-edges going to the back are already paired. You can still move them one at a time, or you can use these shortcuts:

~~~~ Move an Edge-Pair ~~~~

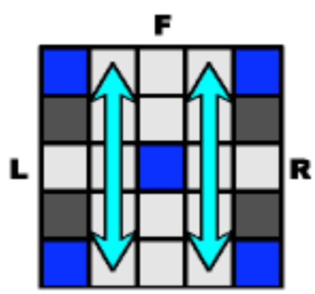
...from the left:



Bottom View

O- B+ O+ B2
O- B+ O+
M- B- M+ B2
M- B- M+

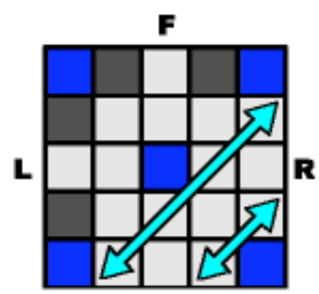
...from the front:



Bottom View

M- M- B2
M- M- B2
M- M-

...from the right:

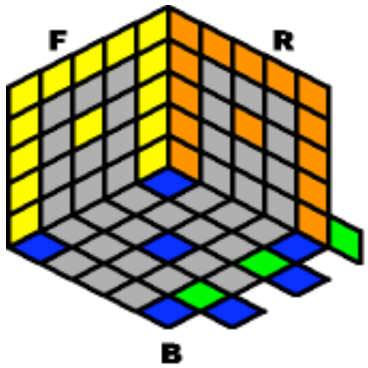


Bottom View

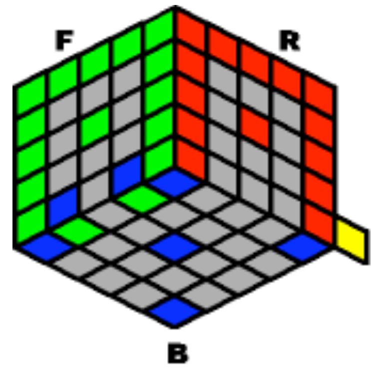
M- B- M+ B2
M- B- M+
O- B+ O+ B2
O- B+ O+

All sequences only have to be performed **once** to accomplish the move.

Both back edges should now be in place...



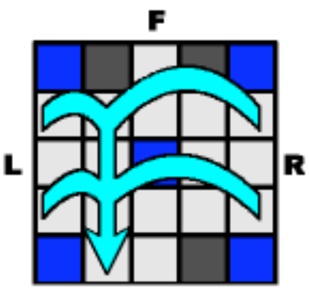
...rotate the entire puzzle so that the fixed edges are in the front...



...and solve the "other" back side.

Once again, you have to use the same sequences as before, except this time, the outer-edges are coming from the sides only.

Move a single edge to the back-left:

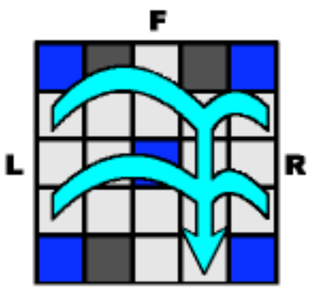


Bottom View

M- B- M+ B2
M- B- M+

(4 times max.)

Move a single edge to the back-right:

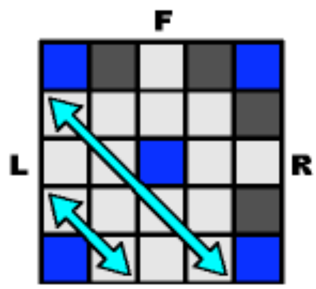


Bottom View

O- B+ O+ B2
O- B+ O+

(4 times max.)

Swap the left pair of edges with the back pair of edges:

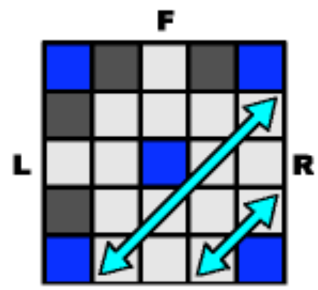


Bottom View

O- B+ O+ B2
O- B+ O+
M- B- M+ B2
M- B- M+

(1 time only)

Swap the right pair of edges with the back pair of edges:

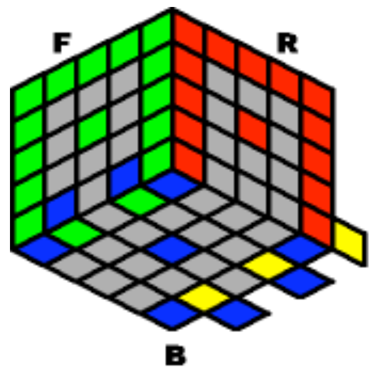


Bottom View

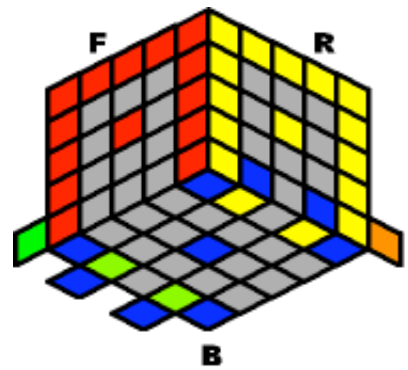
M- B- M+ B2
M- B- M+
O- B+ O+ B2
O- B+ O+

(1 time only)

The back and front edges are now in place....



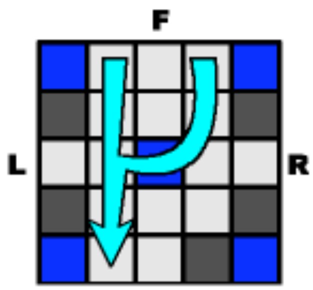
...rotate the entire puzzle so that the fixed edges are on the sides...



...and solve the back side again.

This time, you only have to use the sequences that move the outer-edges from the front to the back:

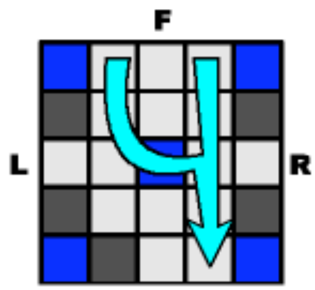
Move a single edge to the back-left:



M- B2 M+ B-
M- B- M+
O- B2 O+ B+
O- B+ O+

(2 times max.)

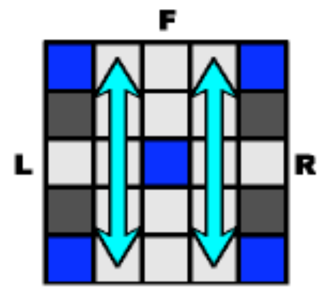
Move a single edge to the back-right:



O- B2 O+ B+
O- B+ O+
M- B2 M+ B-
M- B- M+

(2 times max.)

Swap the front pair of edges with the back pair of edges:



M- M- B2
M- M- B2
M- M-

(1 time only)

Once you solve the back side (for the third time), the remaining 2 outer-edges are forced to the front side, where they belong! Therefore, all 8 bottom outer-edges are in place. Now for the next step: INVERSION.

Inversion

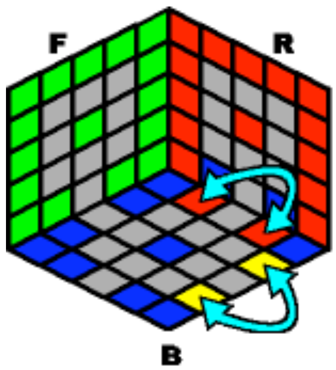
There are 5 different inversion schemes:

1. **Invert 2 outer-edge pairs on adjacent sides**
2. **Invert 2 outer-edge pairs on opposite sides**

3. **Invert 4 outer-edge pairs**
4. **Invert 3 outer-edge pairs**
5. **Invert 1 outer-edge pair**

For each inversion scheme, you must rotate the entire puzzle so that the inverted edge-pairs are positioned exactly like the ones in the diagrams, *before* attempting the sequence of moves!

~~~~ Case #1: Invert two adjacent edge-pairs ~~~~

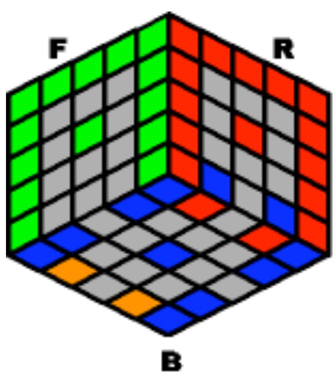


[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2
[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2

Result:

The bottom outer-edges are solved.

~~~~ Case #2: Invert two opposite edge-pairs ~~~~

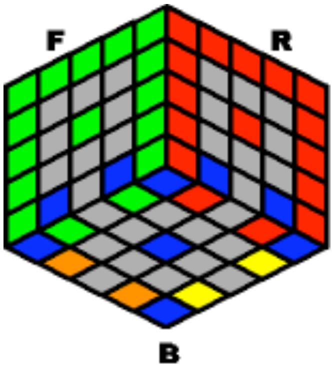


[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2
[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2

Result:

Two adjacent edge-pairs are still inverted.
Go back to Case #1,
do the sequence, and the bottom edges are solved.

~~~~ Case #3: Invert four edge-pairs ~~~~

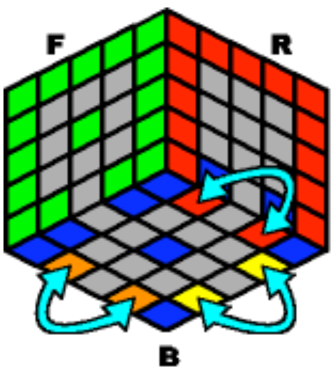


[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2
[MNO]- B- [MNO]+ B-
[MNO]- B2 [MNO]+ B2

Result:

Two adjacent edge-pairs are still inverted. Go back to Case #1, do the sequence, and the bottom edges are solved.

~~~~ Case #4: Invert three edge-pairs ~~~~

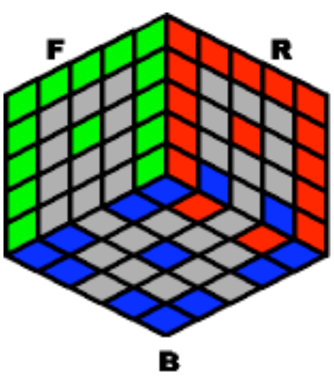


M- B- M- B2
M- B2 M+ B+ M+
O- B- O- B2
O- B2 O+ B+ O+
M- B- M- B2
M- B2 M+ B+ M+

Result:

The bottom outer-edges are solved.

~~~~ Case #5: Invert one edge-pair ~~~~



M- B- M- B2
M- B2 M+ B+ M+
O- B- O- B2
O- B2 O+ B+ O+
M- B- M- B2
M- B2 M+ B+ M+

Result:

Two adjacent edge-pairs are still inverted. Go back to Case #1, do the sequence, and the bottom edges are solved.

As it turns out, only two different sequences were used throughout all five cases. Now that the bottom outer-edges are solved, the next thing to tackle are the [Bottom Inner-Edges.]

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges
@ Middle Outer-Edges @ Middle Inner-Edges
@ Bottom Corners @ Bottom Outer-Edges @ Bottom Inner-Edges
@ Middle & Bottom Faces

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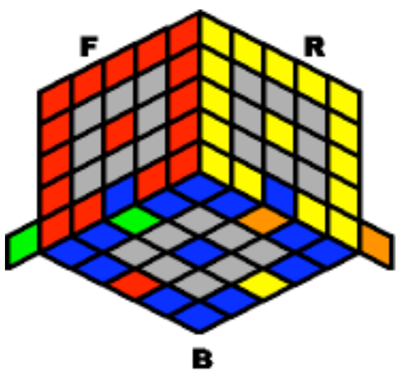
The Professor's Cube

IX. Solve the Bottom Inner Edges

The remaining 4 inner-edges are already on the bottom layer, where they belong. The first step is to arrange them in the correct positions. At this point, there are three possibilities:

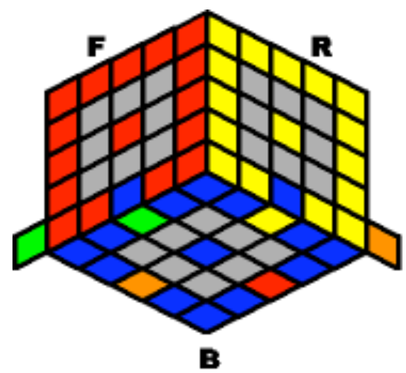
- **NO inner-edge is in place**
- **Only 1 inner-edge is in place**
- **All 4 inner-edges are in place**

If **NO** inner-edge is in place, then use the sequence below:



Before

N- B- N+ B2
N- B- N+



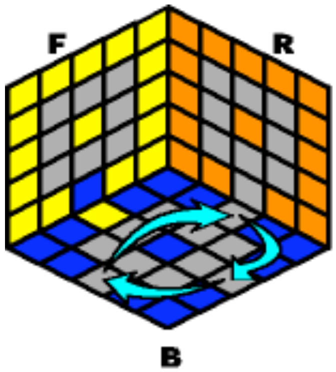
After

You only need to do this sequence **once.**

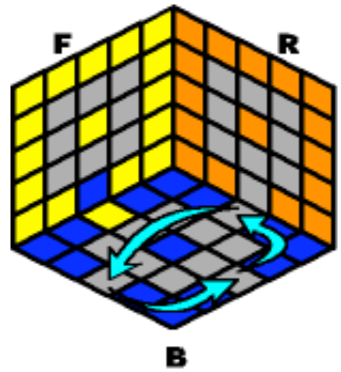
Note: Ignore the diagrams. As long as you keep the original top face on the top side, this sequence will guarantee that at least ONE bottom inner-edge will land in place afterwards.

If only **ONE** inner-edge is in place, then rotate the entire puzzle until the fixed inner-edge piece appears on the bottom front. The remaining 3 inner-edges need to be swapped either clockwise or counter-clockwise.

Exchange Clockwise:	**Exchange Counter-Clockwise:**



N- B+ N+ B2
N- B+ N+



N- B- N+ B2
N- B- N+

You only need to memorize **one** of the above. For example, if you choose to memorize the "counter-clockwise" sequence, then use it **twice** to swap the 3 edges clockwise. Once all 4 inner-edges are arranged in place, get ready for the last step: INVERSION.

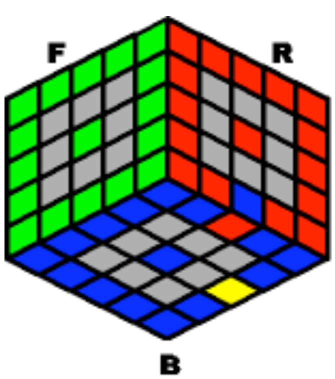
Inversion

There are 3 different inversion schemes:

1. **Invert 2 adjacent inner-edges**
2. **Invert 2 opposite inner-edges**
3. **Invert all 4 inner-edges**

For each inversion scheme, you must rotate the entire puzzle so that the inverted edges are positioned exactly like the ones in the diagrams, *before* attempting the sequence of moves!

~~~~ Case #1: Invert two adjacent edges ~~~~

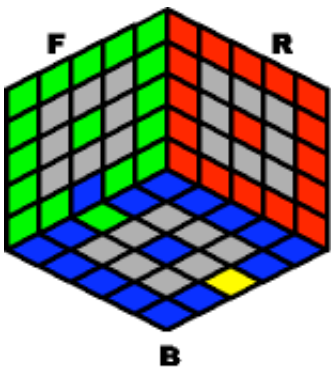


N- B- N+ B-
N- B2 N+ B2
N- B- N+ B-
N- B2 N+ B2

Result:

The bottom inner-edges are solved. In fact, all the bottom edges are solved.

~~~~ Case #2: Invert two opposite edges ~~~~

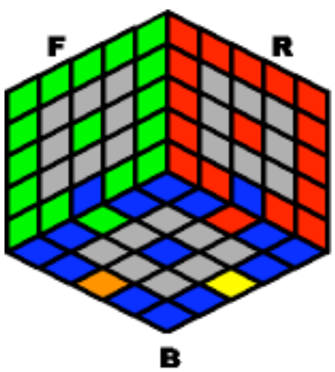


N- B- N+ B-
N- B2 N+ B2
N- B- N+ B-
N- B2 N+ B2

Result:

Two adjacent edges are still inverted. Go back to Case #1, do the sequence, and the bottom edges are solved.

~~~~ Case #3: Invert all four edges ~~~~



N- B- N+ B-
N- B2 N+ B2
N- B- N+ B-
N- B2 N+ B2

Result:

Two adjacent edges are still inverted. Go back to Case #1, do the sequence, and the bottom edges are solved.

As it turns out, the *same sequence* was used throughout *all three cases*. Now that all the bottom edges are solved, the only thing left are the **Middle and Bottom Faces.**

@ Notation / Top Face
@ Top Corners @ Top Outer-Edges @ Top Inner-Edges
@ Middle Outer-Edges @ Middle Inner-Edges
@ Bottom Corners @ Bottom Outer-Edges @ Bottom Inner-Edges
@ Middle & Bottom Faces

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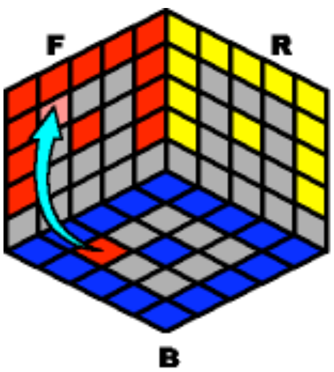
The Professor's Cube

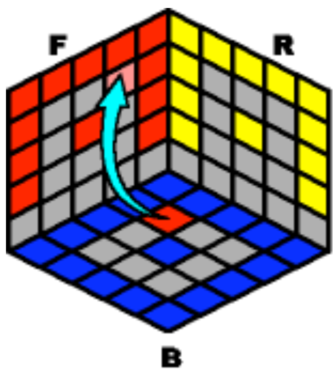
X. Solve the Middle and Bottom Faces

Swap the Outer Faces:

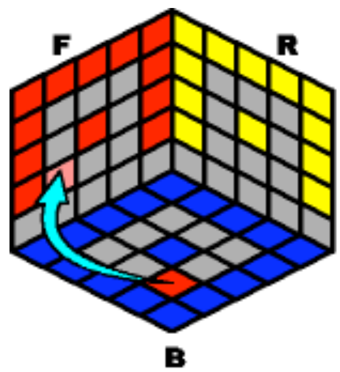
The end is near. Use either of the four moves below to place an outer-face from the bottom layer to one of the vertical sides. You may have to rotate the bottom layer first to get everything set. Do not attempt to solve an entire side at a time; just keep climbing a center face somewhere from the bottom side to its proper side. What happens to the square that it lands on? It gets sent down to the bottom layer, so each of these four moves can also be used as **knock-downs.**



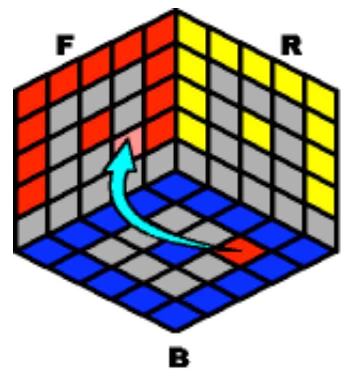
M- B+ O- B- M+ B+ O+



O- B- M- B+ O+ B- M+



M- B- O- B+ M+ B- O+



O- B+ M- B- O+ B+ M+

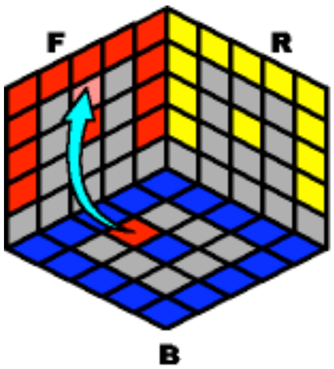
Hint: try not to knock down any center face that has the same color as the bottom face. If you do, then the bottom face will fill up and force you to do more knock-downs later on, which is unnecessary.

Shortcut: Swap all 4 outer-faces from the bottom side to the front side:

M- B- O- B+
M+ B2 M- B+
O+ B2 O- B+
M+ B2 M- B+
O+ B- M+

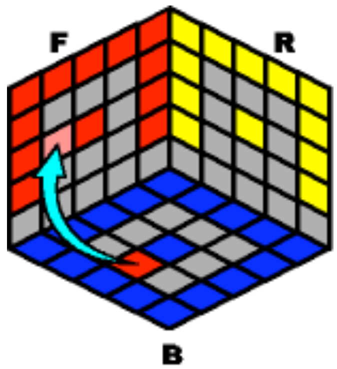
Swap the Inner Faces:

Use either of the four moves below to place an inner-face from the bottom layer to one of the vertical sides. You may have to rotate the bottom layer first to get everything set. Note that there is an *alternate* sequence for every swap; they are provided here just in case the *main* sequence feels uncomfortable to the user. Just as before, the target face gets sent down to the bottom layer by the source face, so each of these four moves can also be used as **knock-downs.**



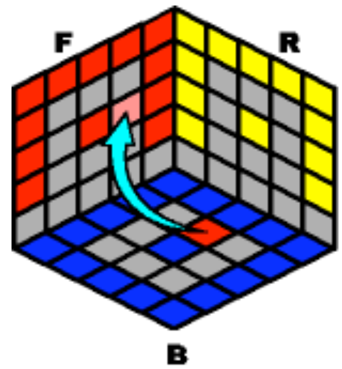
N- B- M- B+
N+ B- M+

Alternate:
N- B+ O- B-
N+ B+ O+



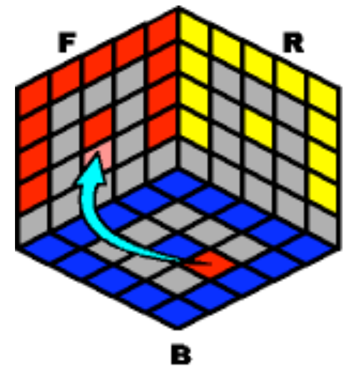
M- B- N- B+
M+ B- N+

Alternate:
M- B+ N- B-
M+ B+ N+



O- B- N- B+
O+ B- N+

Alternate:
O- B+ N- B-
O+ B+ N+



N- B- O- B+
N+ B- O+

Alternate:
N- B+ M- B-
N+ B+ M+

Hint: once again, try not to knock down any center face that has the same color as the bottom face. If you do, then the bottom face will fill up and force you to do more knock-downs later on, which is unnecessary.

It is not neccessary to finish all outer-faces before doing the inner-faces; so you can complete an entire vertical side if you want, even though that is not recommended. After finishing all of the vertical sides, the last 8 center faces are automatically forced to the bottom layer, where they belong anyway. The bottom layer could still be out of sync, so give it another twist and THE PUZZLE IS OVER!

Summary:

- Solve the top center faces FIRST
- Solve the top corners and top edges (in any order)
- Solve the inner and outer equatorial edges (in any order)
- Solve the 4 bottom corners
- Solve the 8 bottom outer-edges
- Solve the 4 bottom inner-edges
- Solve the other five faces LAST.

THE END

@ Notation / Top Face
@ Top Corners **@ Top Outer-Edges** **@ Top Inner-Edges**
@ Middle Outer-Edges **@ Middle Inner-Edges**
@ Bottom Corners **@ Bottom Outer-Edges** **@ Bottom Inner-Edges**
@ Middle & Bottom Faces

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