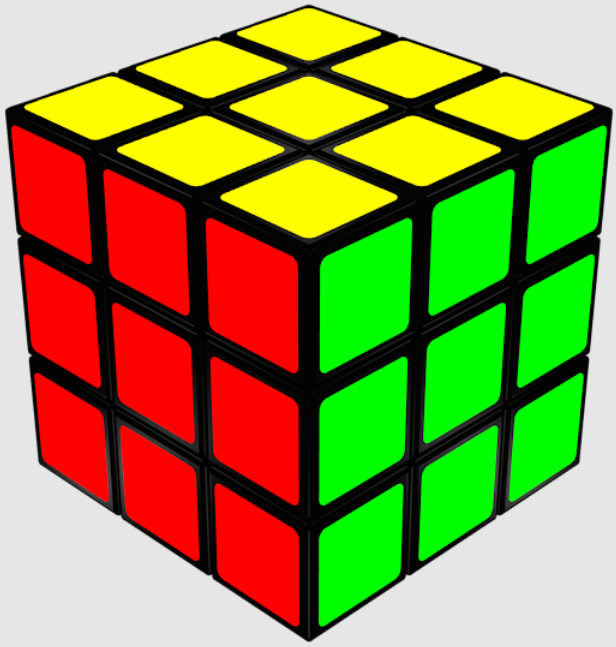
Ibero Rubik

3x3x3 Cube
Fridrich Method (modified)



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Contents

List of Tables

Introduction

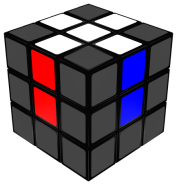
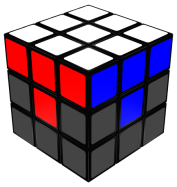
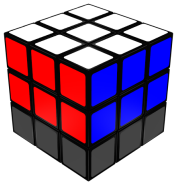
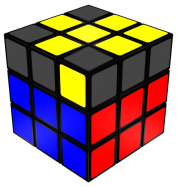
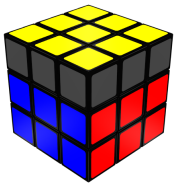
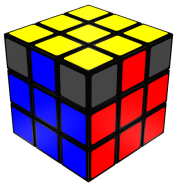
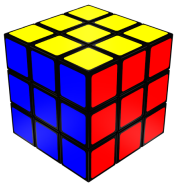
This method is called Fridrich Method, and also CFOP, because of the four parts this method can be divided into:

- *Cross*: Make a cross in a face and match the edges that form it with the center pieces of the faces next to the cross.
- F2L: *First Two Layers*. The aim is to complete two layers of the cube: the one containing the cross and the one placed below. This step is divided into two parts:
  - Placing the first layer corners
  - Placing the second layer corners
- OLL: *Orientation of the Last Layer*. We have to make the face opposite to the cross contain just one colour. This step will be divided into two parts:
  - Preparation of the last layer
  - Complete orientation of the last layer

  This subdivision does not come from the Fririch method, but it allows to learn less algorithms. This will be explain clearly later.
- PLL: *Permutation of the Last Layer*. This part is to change the position (*permutation*) of the pieces of the last layer, without rotating them. Then the cube would be solved. This step is also divided into two parts:
  - Permutation of edges
  - Permutation of corners

To sum up, from four steps (C, F2L, OLL, PLL) we get seven parts the method is subdivided into:

Table 1: Parts of the method

	Part	Scheme
1	Cross.	
2	Placing of the first layer corners.	
3	Placing of the second layer edges.	
4	Preparation of the last layer.	
5	Complete orientation of the last layer.	
6	Permutation of edges.	
7	Permutation of corners.	

As an example to illustrate these explanations, the white face has been chosen to be solved first, and the yellow face will be the last one. However, this can be applied to no matter what couple of opposite colours of the cube.

1 Cross

Here, the aim is to get a cross in a face, considered as the upper face, and to match the colour of the cross edges with the colour of the center pieces placed in the middle layer (Figure 1).

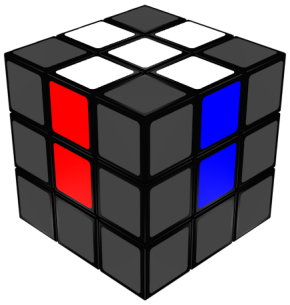
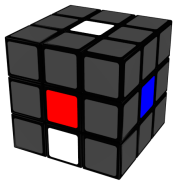
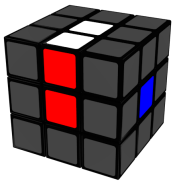
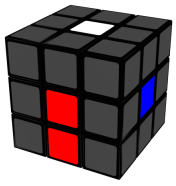
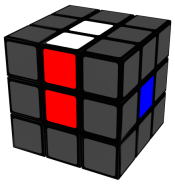


Figure 1: Situation of the cube once the first part of the method is made.

The steps are the following:

- Move the whole cube so that de white center is on the top of the cube.
- We have to find a edge with white-coloured sticker. This piece will contains another colour. We will bear in mind this colour for future steps.
- By turning the layer this edge belongs to, place it in the lower part of the cube.
- Turn the lower layer of the cube (now containig the edge) until the edge is positioned in the face of the same colour of that one we paid attention before.
- There are two possibilities (Table 2):
  - If the white sticker is vertical (is not on the lower part of the cube), then the movement is: DRF'
  - If the white sticker is horizontal (is on the lower part of the cube), then the movement is: F2

Table 2: Posibilities while making the cross

Starting situation	Movement	Final situation
	DRF'	
	F2	

- Repeat with all the edges containing a white sticker (we recommend to find next the edge placed on the left or on the right in the solved cube; the process will be easier).

2 Placing of the first layer corners

The aim is to place correctly the corners containing the white colour, to complete the white face and to create some T in the vertical faces (Figure 2):

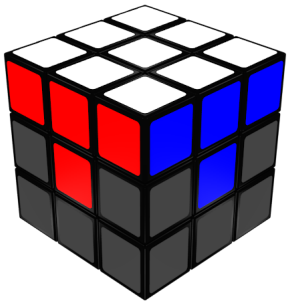


Figure 2: Situation of the cube once the second part of the method is applied.

Hold the cube with a face in front of you; if the piece of the right upper corner contains a white sticker, there are two cases: the piece is the one which should be in that position (piece well posisitioned; Table 3), or should not be in that position (piece badly positioned; Table 4).

Table 3: Algorithms of the 2^{nd} part to orientate the right upper corner (well positioned)

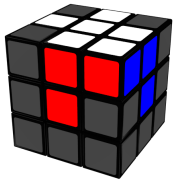
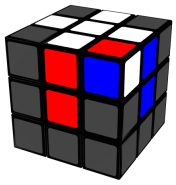
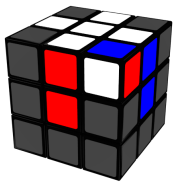
Figure	Description	Algorithms
	Trivial case, correct position and orientation.	-
	Correct position, incorrect orientation; white on the right.	R'D'RDR'D'R
	Correct position, incorrect orientation; white in the front.	R'DRD'R'DR

Table 4: Algorithms of the 2^{nd} part to orientate the right upper corner (badly positioned)

Figure	Description	Algorithms
	Incorrect position; white on the top.	1^{st} option R'D'R 2^{nd} option R'DR
	Incorrect position; white on the right.	R'D'R
	Incorrect position; white in the front.	R'DR

This can be used when the left upper corner contains a white sticker. There are too cases, too (piece well positioned; Table 5, or piece badly posotioned; Table 6).

Table 5: Algorithms of the 2^{nd} part to orientate the left upper corner (well positioned)

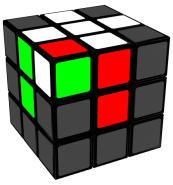
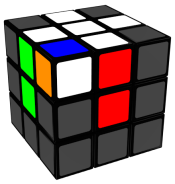
Figure	Description	Algorithms
	Trivial case, correct position and orientation.	-
	Correct position, incorrect orientation; white on the left.	LDL'D'LDL'
	Correct position, incorrect orientation; white in the front.	LD'L'DLD'L'

Table 6: Algorithms of the 2^{nd} part to orientate the left upper corner (badly positioned)

Figure	Description	Algorithms
	Incorrect position; white on the top.	1ª opción LDL' 2ª opción LD'L'
	Incorrect position; white on the left.	LDL'
	Incorrect position; white in the front.	LD'L'

The cases in which the corner is on the left (Tables 5 and 6) can be replaced by those in which the corner ends up on the right (Tables 3 and 4) with just a turn of the whole cube. Although they are explained here so that this guide is more complete and to avoid turning the cube, right-handed people will prefer the movements described in Tables 3 and 4, and left-handed will prefer those of Tables 5 and 6.

3 Placing of the second layer edges

3.1 If there are edges without yellow colour in the upper layer

In this part, we will turn the cube upside down, so that the yellow face is on the top. The steps are the following:

- Locate an edge with no yellow sticker (in Figure 3, it is a red and blue edge piece).

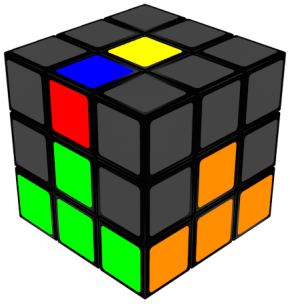


Figure 3: Edge without yellow sticker, with red and blue colours.

- By turning the upper face, take the edge to the face of the colour of the vertical sticker (in the case shown in Figure 3, to the red face, since the vertical sticker of the edge piece is red).
- Find the position of this edge in the solved cube (in Figure 4, it is the edge piece shared by red and blue faces, and it is in close-up. By doing this, we look at the faces the edge will be placed between (in this case, the blue and the red ones).

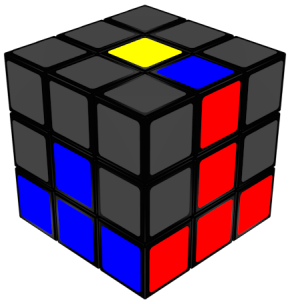
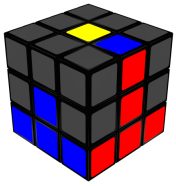
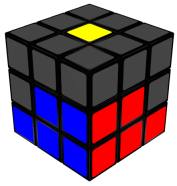
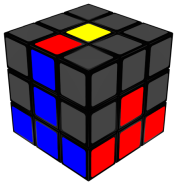
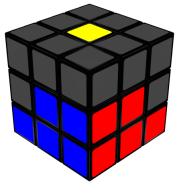


Figure 4: Situation of the cube once the edge has been placed in its face, as described above.

- At this point, there are two cases (Table 7):

Table 7: Possibilities when making the cross

Starting situation	Description	Movements	Final situation
	The edge is on the right. The first part of the movements is applied on the right face, and the second part, on the left face, with a previous turn of the whole cube.	U'L'UL - y' - URU'R'	
	The edge is on the left. The first part of the movements is applied on the left face, and the second part, on the right face, with a previous turn of the whole cube.	URU'R' - y - U'L'UL	

3.2 If there is no edges without yellow colour in the upper layer

Everything described above let us place correctly an edge of the upper layer without yellow colour, by moving the "wrong" edge to the middle layer. However, We may not find any edge without a yellow sticker in the upper face. That means at least two edges of the middle layer are exchanged. To solve this problem, we can use the previous algorithms twice: The first time to move the wrong edge to the upper layer, and the second time to place it correctly. This is explained in Figure 5.

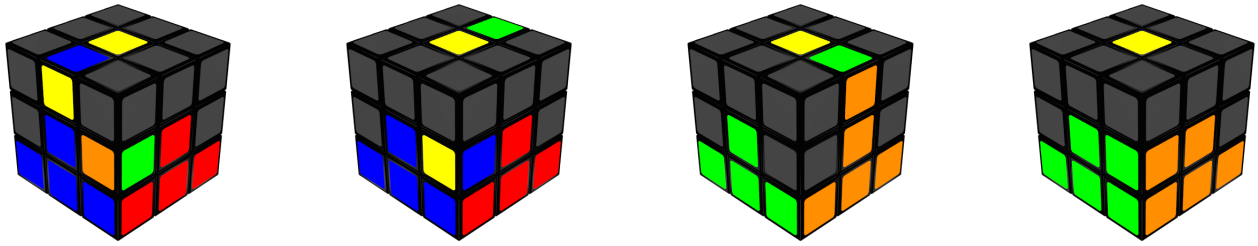


Figure 5: Case in which there are no edges without yellow sticker in the upper layer.

3.3 Edge well positioned but badly oriented

Last, an edge can be well positioned, but badly oriented (Figure 6). In this case, instead or moving the edge piece to the upper layer and then place it correctly, there is a faster option: turn the whole cube until the edge is on the right, and do this algorithm:

R2U2FR2F'U2R'UR'

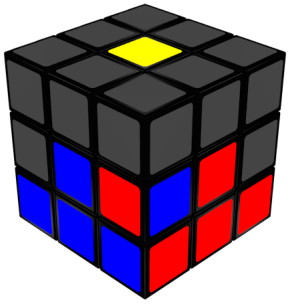


Figure 6: Case of edge well positioned and badly oriented.

4 Preparation of the last layer

Once the two lower layers of the cube are solved, we still have to solve the layer containing the yellow face. The Fridich method makes us to learn many different cases. Here, we are going to reduce the number of cases, looking for a balance between memorizing and speed (if the number of cases learnt is reduced too much, the movements are usually used several times to find a known situation, and that takes too long).

The images that describe this case are shot from above and maintaining only the colour yellow. An example of the process followed to get the images is this:

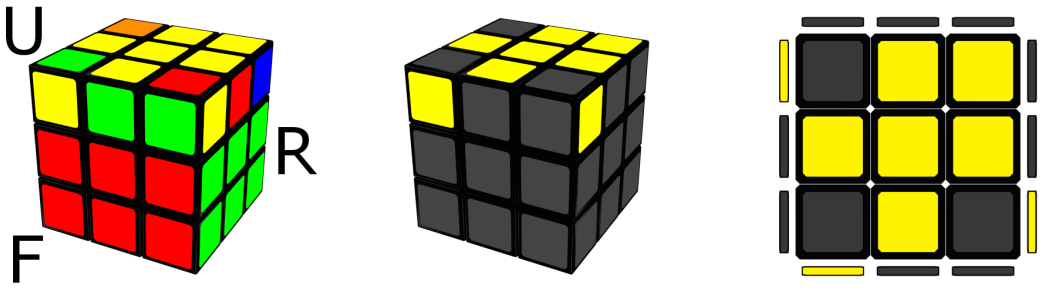
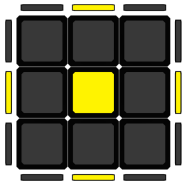
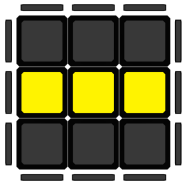
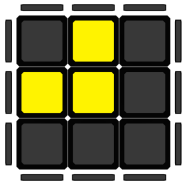


Figure 7: Left: Cube with every colour. Center: Only yellow is left. Right: Top view, with the front face below.

In this part, we can find three cases:

Table 8: Algorithms to prepare the last layer

Case	Figure	Algorithms
1		FB'URU'R'U'R'U'RUF'B
2		FRUR'U'F'
3		FURU'R'F'

What is shown in pictures of Table 8 is the minimum amount of yellow stickers that should be so that the algorithm works. Which means more yellow stickers can be in the upper face, but never less. For instance, in the case of Figure 8, we would use the algorithm 3 of the previous Table.

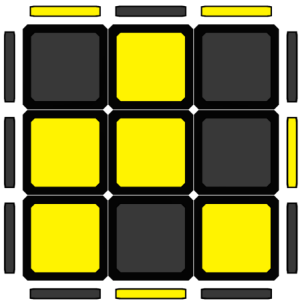
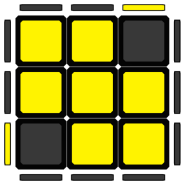
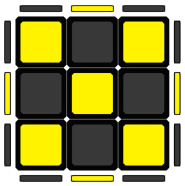
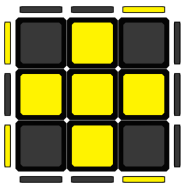
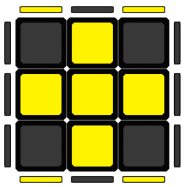
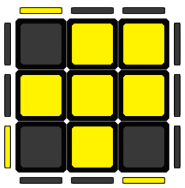
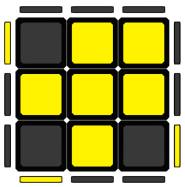
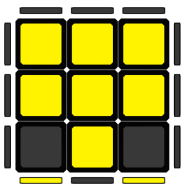
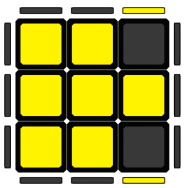


Figure 8: Particular case of preparation of the last layer.

5 Orientation of the last layer

Table 9: Algorithms of orientation of the last layer

Case	Figure	Algorithms	Comments
1		R'F'L'FRF'LF	
2		FB'URU'R'U'R'U'RUF'B	Identical algorithm to case 1 of the previous part.
3		RU2R2U' - R2 - U'R2U2R	
4		RU2R'U' - RUR'U' - RU'R'	
5		U2 - RUR'URU2R'	
6		RU2R'U'RU'R'	The opposite of case 5 (removing the first 180º turn).
7		R2DR'U2 - RD'R'U2 - R'	
8		R'F'LFRF'L'F	Very simmilar to case 1.

6 Permutation of edges

At this point, we have to permute the edges, which means to change their position, but not their orientation. It is necessary to look at the number of edges well positioned (as an example, in Figure 9, the red and yellow edge is in the correct position.

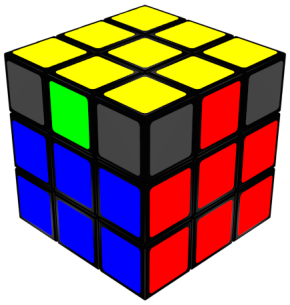


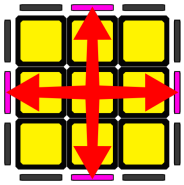
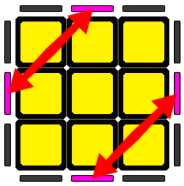
Figure 9: Example of a well posisioned edge (the red and yellow one).

Move the top layer, to see how many well-positioned edges we can get. There are three cases:

6.1 0 edges well positioned

How are the edges exchanged? There are two possibilities (in Table 10):

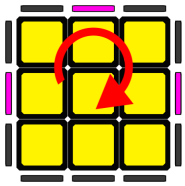
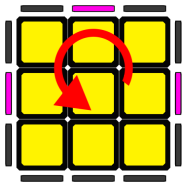
Table 10: Permutation of edges - 0 edges well positioned

Case	Figure	Description	Algorithms
1		Seen from above, the edges are exchanged forming a cross.	M2U - M2U2 - M2U - M2
2		Seen from above, the edges are exchanged diagonally.	RB'R'B - FR'F - B'R'BR - F2 - U

6.2 1 edge well positioned:

Turn the upper layer (or the whole cube, to see what is happening more clearly), until the matched edge is opposite us. In this point, there are two possibilities (see Table11):

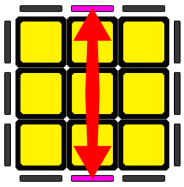
Table 11: Permutation of edges - 1 edge well positioned

Case	Figure	Description	Algorithms
1		Seen from above, the edges must turn clockwise.	R'U - R'U' - R'U' - R'U - RUR2
2		Seen from above, the edges must turn counterclockwise.	R2U'R' - U'R - UR - UR - U'R

6.3 2 edges well positioned:

In this case, there is only a possibility (Table 12):

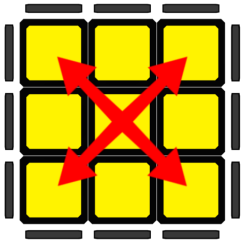
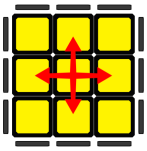
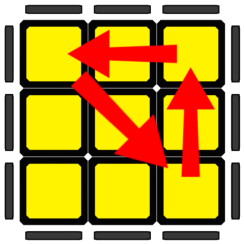
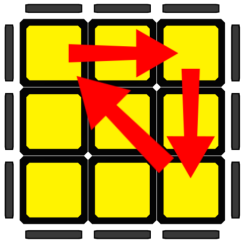
Table 12: Permutation of edges - 2 edges well positioned

Case	Figure	Description	Algorithm
1		Seen from above, the correct edges must be on the right and on the left. To get that, turn the upper layer (or the whole cube, to see it better).	RB'R'B - FR'F - B'R'BR - F2

7 Permutation of corners

Once the edges have been placed correctly, just the corner remain to be solved. The possibilities are (Table 13):

Table 13: Permutation of corners

Case	Figure	Description	Algorithms
1		With a 180º turn of the upper layer it turns out to be an edges permutation (forming a cross): 	U2 - M2U - M2U2 - M2U - M2
2			R2B2RF - R'B2 - RF'R
3		The opposite to the previous case.	R'FR' - B2R - F'R'B2R2

After applying these steps, the cube will be solved.

This guide and much more at:

www.iberorubik.com