Beginner's Method for Solving the 4x4 Cube

Supplementary to video tutorials at
https://www.cubeskills.com/tutorials/beginners-method-for-solving-the-4x4-cube

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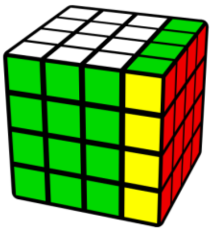
Images sourced from Conrad Rider's VisualCube - http://cube.crider.co.uk/visualcube.php

Notation

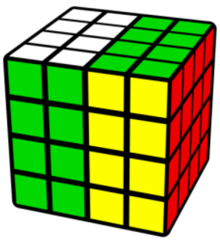
Due to the additional layer on the 4x4 we need to define some new notation to solve the cube. An upper-case letter followed by a w denotes a 'wide' or double layer turn of the side. A lower-case letter denotes an inner slice move. These are shown below.

Example Moves

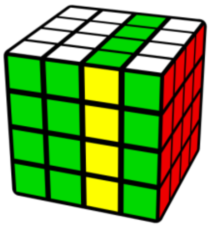
R (Outer Face)



Rw (Wide turn – 2 layers)



r (Inner Slice)



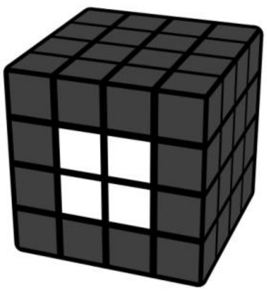
The Reduction Method

To solve the 4x4, we will use what is known as the reduction method. Essentially, this involves 'reducing' the cube to a state that can be solved as if it were a 3x3 cube, by solving the center pieces and pairing up the matching edge pieces.

Solving The Centers

The first step in solving the 4x4 is to solve the center pieces. Unlike on a 3x3, there are no fixed center pieces, so we need to form the centers ourselves. There are four center pieces of each colour on the cube, and we need to not only match them up, but also ensure that we solve the centers into their correct relative positions.

The first step here is to solve two centers onto opposite faces from one another. After solving the first two centers on opposite sides, hold them on the left and right hand side of the cube and solve the remaining 4 centers. It is recommended to solve the 3rd and 4th center adjacent to one another. For more detail on this step, please refer to the video tutorials linked at the beginning of this document.

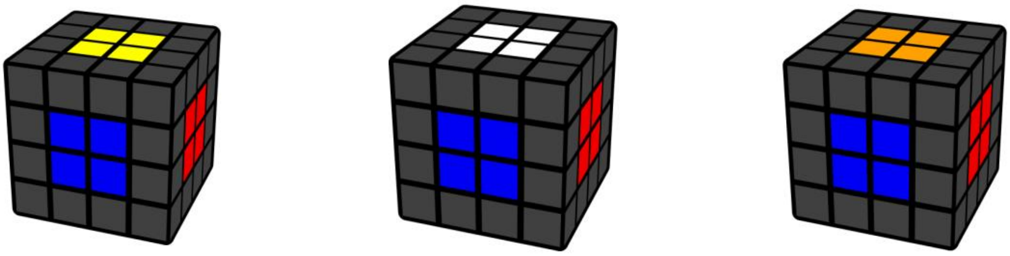


A solved white center

When solving the centers, it is important to solve them into their correct locations. On a cube with the standard colour scheme, the white centers belong opposite yellow, blue opposite green, and red opposite orange. However, we also need to account for the fact that there are two ways that this can be accomplished.

A simple way to memorise this is that the blue center, yellow center, and red center follow each other in a clockwise direction around the cube. Another way is 'BOY', which is the same thing but using different colours – Blue, Orange, Yellow.

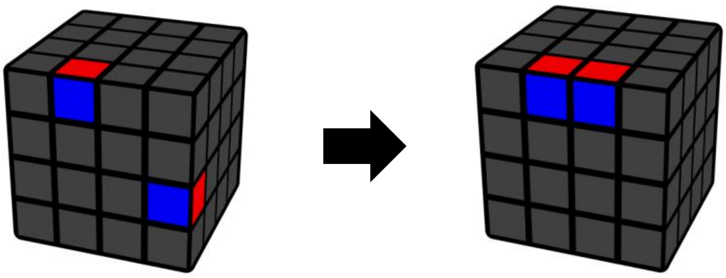
The image on the left shows the correct placement of the yellow center relative to the red and blue centers, whilst the other two images show incorrect placement of centers on a cube with a standard colour scheme.



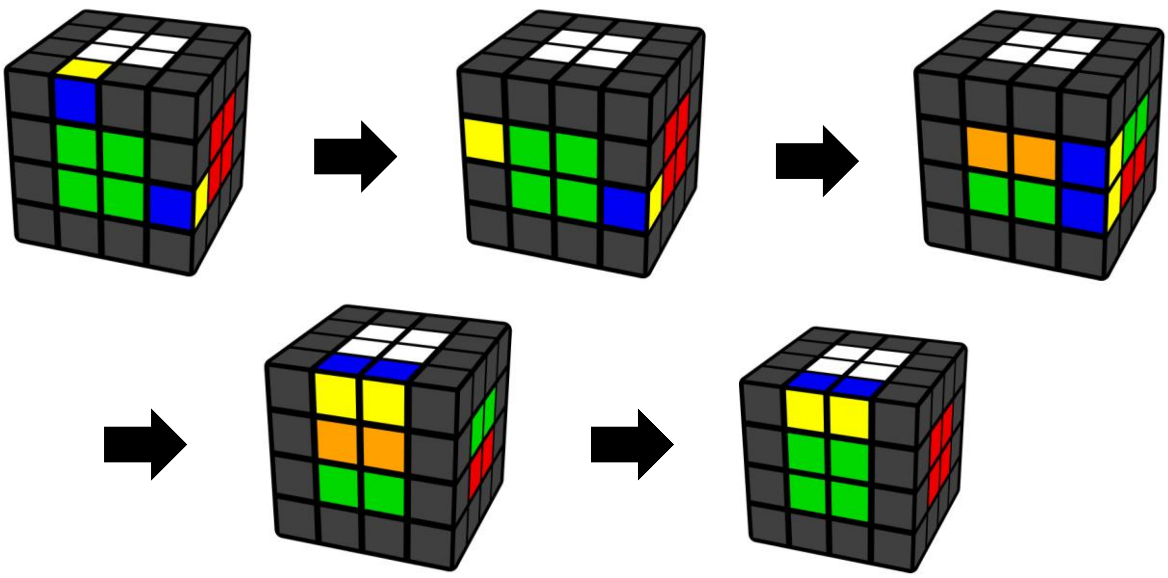
CORRECT **INCORRECT** **INCORRECT**

Edge pairing

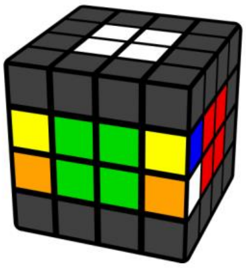
The second step in the reduction method is to pair up matching edge pieces. For every combination of two colours on the cube (excluding opposites), there will be two edge pieces which have those colours. Our goal is to pair them all up as shown in the figure below.



To do this, we will need to turn the outer faces of the cube to place the two individual edge pieces in the front left and front right slots, ensuring that they are in different layers. We then temporarily break up our solved centers to match up these edge pieces and move the now-solved edge pair into the top layer. When moving it to the top layer we need to ensure that we don't mess up our centers in the process - moves such as R U R' and R U' R' move an edge from the front right slot to the top layer. This process is outlined with images below and is shown in more depth in the tutorial videos.



Continue this process until all the edges are paired up. If you encounter a situation where you only have two edges left to solve, position them as shown below and perform the following algorithm.



Uw' (R U R' F R' F' R) Uw

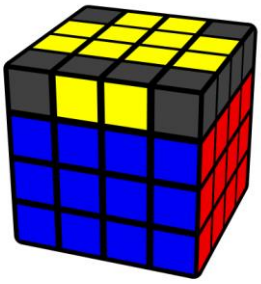
3x3 Stage

After solving the centers and pairing up the edges, you can now effectively solve the cube as if it were a 3x3. The centers you have formed on a 4x4 are equivalent to the single centers on a 3x3, and each pair of two 4x4 edge pieces is equivalent to a single edge on a 3x3 cube. The corner pieces are the same on both cubes. Using the outer layers, go on and solve the cube like a 3x3.

Parities

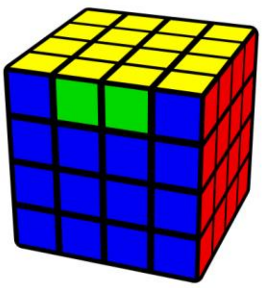
When you get to the last layer of the 4x4, there are two possible 'parity' cases – these are states that you can encounter during the 3x3 stage on a 4x4 which aren't possible on a 3x3.

The first parity is known as OLL parity, which is when there are an odd number of oriented edge pieces on the cube. The algorithm we will use to fix OLL parity is as follows.



Rw U2 x Rw U2 Rw U2 Rw' U2 Lw U2 Rw' U2 Rw U2 Rw' U2 Rw'

The second parity you may encounter is PLL parity, which occurs when we have an odd number of edge pair/corner swaps during PLL. This means you will have a PLL case which isn't possible on a standard 3x3 cube. To fix PLL parity, we use the following algorithm which swaps the front and back edge pairs.



r2 U2 r2 Uw2 r2 Uw2 (U2)

Congratulations on solving the 4x4 Rubik's cube!