Rubik's cube handout (Steven Miller: sjm1@williams.edu)

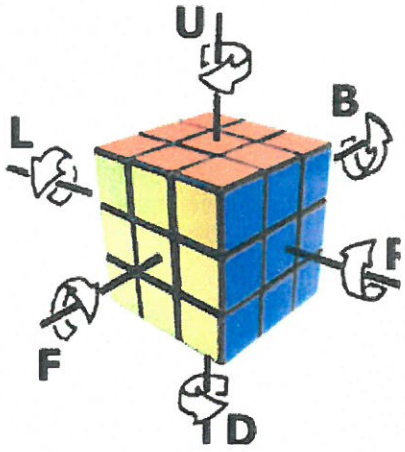
Nice online (animated): http://ruwix.com/the-rubiks-cube/notation/

Solution for 2x2x2: http://lghttp.38568.nexcesscdn.net/8013252/pdf/uploads/general_content/Rubiks_Cube_2x2x2_solving_guide.pdf

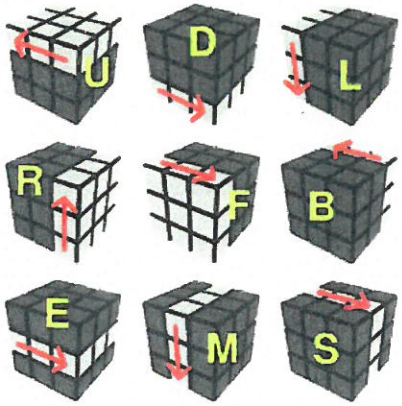
Notation: From http://rubiks.wikia.com/wiki/Notation

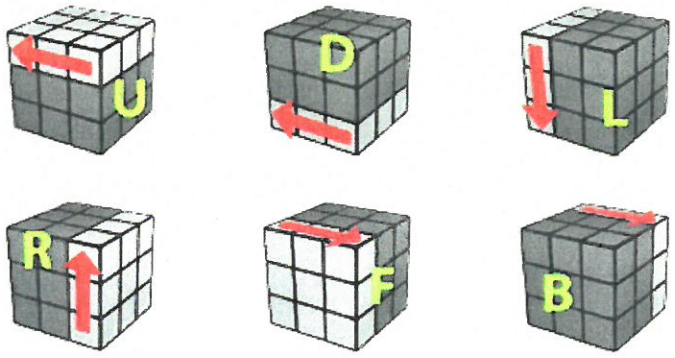
Most 3×3×3 Rubik's Cube solution guides use the same notation, originated by David Singmaster, to communicate sequences of moves. This is generally referred to as "Cube notation" or in some literature "Singmaster notation" (or variations thereof). Its relative nature allows algorithms to be written in such a way that they can be applied regardless of which side is designated the top or how the colours are organized on a particular Cube.

- *F* (Front): the side currently facing you
- *B* (Back): the side opposite the front
- *U* (Up): the side above or on top of the front side
- *D* (Down): the side opposite Up or on bottom
- *L* (Left): the side directly to the left of the front
- *R* (Right): the side directly to the right of the front

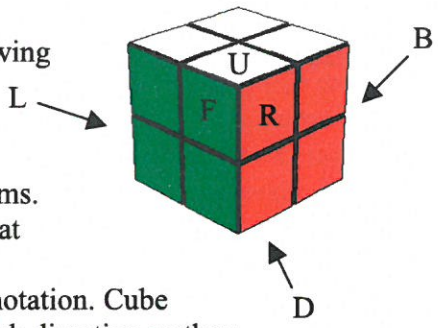


When a prime symbol ['] follows a letter, it means to turn the face counter-clockwise a quarter-turn, while a letter without a prime symbol means to turn it a quarter-turn clockwise. Such a symbol is pronounced *prime*. A letter followed by a *2* (occasionally superscript) means to turn the face a half-turn (the direction does not matter).





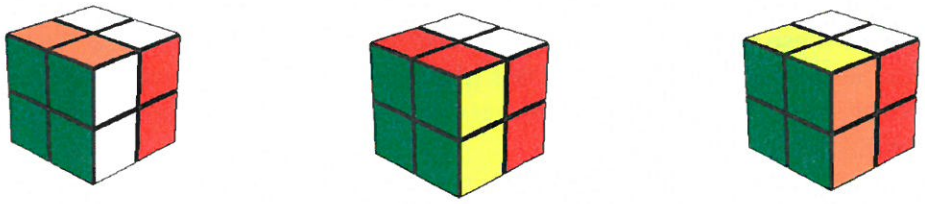
In the diagrams I use for examples, I will use the following face positions:



Cube Notation:

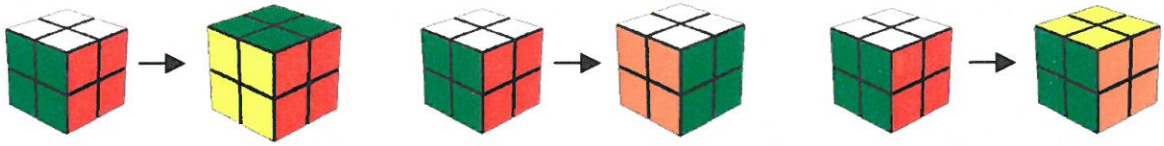
Cube Notation is basically the language of algorithms. An Algorithm (alg for short) is a sequence of moves that causes certain pieces on the cube to move or rotate in certain ways. These algs are written down using cube notation. Cube Notation lets the reader know what face to turn, in which direction so they can use the alg. Here is an example algorithm (If you don't know this one yet, don't learn it and get head of yourself) R U R' U R U2 R'. This algorithm contains 3 of the 6 cube notation tags. The 6 notation tags are: just a capital letter, a capital letter with an apostrophe, a capital letter with a 2, a lower case letter, a lower case letter with an apostrophe, and a lower case letter with a 2. If you have just a capital letter, you would turn the face with the same name as that letter clockwise 90^0. If you have a capital letter with an apostrophe, you would turn the specified face counterclockwise 90^0. If the capital letter has a 2 beside it, then you turn that face 180^0. Here are some examples:

F F' F2



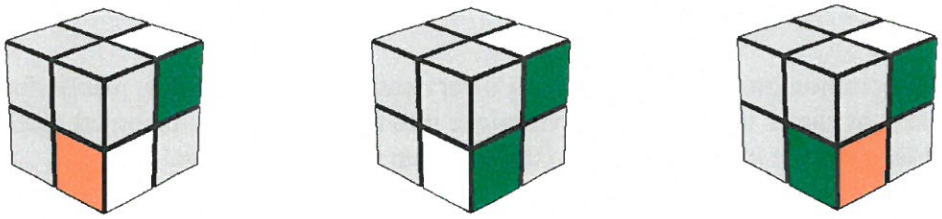
There are more aspects of cube notation such as lower case notation and M, E, and S turns but these don't apply to the 2x2 so I'll leave those aspects for solving a 3x3. However, there is one more thing about cube notation to teach, these are x, y, and z rotations. Alike U, R, L, F, D, and B turns, x y z rotations can also be found as just capital, capital with an apostrophe, and capital with a 2. For these the same rules apply: capital = 90^0 clockwise, apostrophe = 90^0 counterclockwise, 2 = 180^0. The only difference is, when performing an x, y, or z rotation, you don't turn a face, you rotate the whole cube. The cube has three axes, the x-axis runs through the right and left sides of the cube, the y-axis runs through the top and bottom of the cube, and the z-axis runs through the front and back of the cube. So for example, an x rotation would rotate the cube 90^0 clockwise along the x-axis, a y' rotation would rotate the cube 90^0 counterclockwise along the y-axis, and a z2 rotation would rotate the cube 180^0 along the z-axis. Here are examples of rotations:

x y' z2

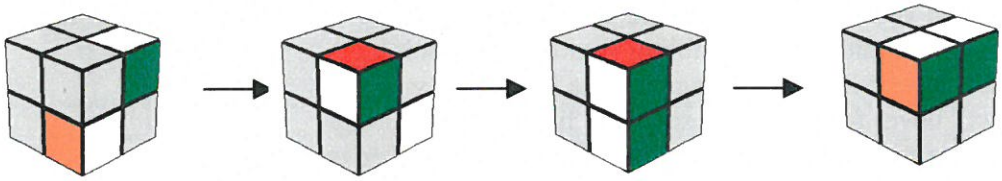


Now rotate the whole cube so that the second piece is in front of you instead of the starting piece. Now you will have one of these three cases (in my examples I will continue to use White Green Red as the starting piece and White Green Orange as the second piece):

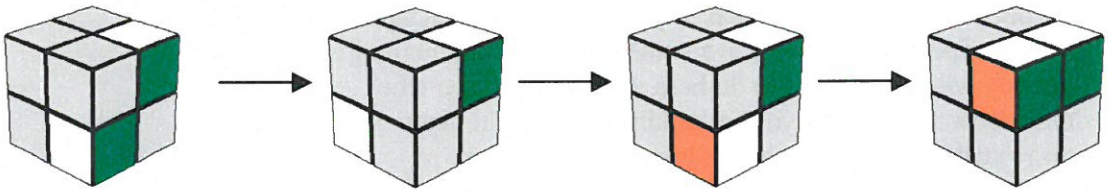
Case 1 Case 2 Case 3



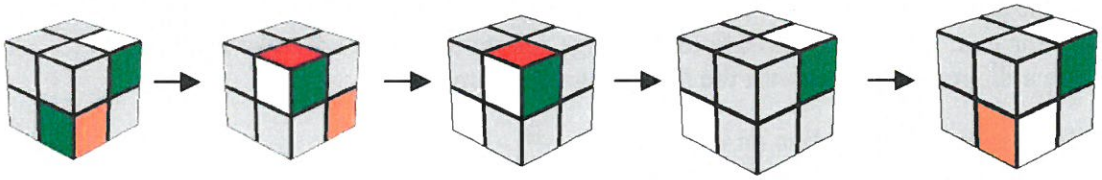
Case 1 is a simple three-move algorithm. R' D' R:



Case 2 is almost the same as case 1 except it's mirrored. F D F':

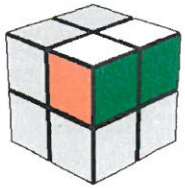


Case 3 is my least favourite because it takes two steps. Do these moves R' D2 R D:



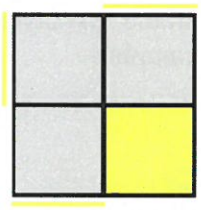
Voila! you now have case 1!

Now you should have a 1x1x2 block like this:

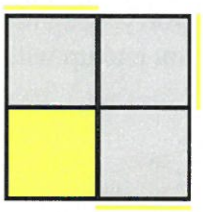


The two algs you'll have to learn to orient the last layer are the left and right Soon algs. Luckily for you, these algorithms aren't very hard to remember but you will have to remember where to use which Soon on which case. First I will show you the two cases that require only one Soon algorithm.

Left Soon = L' U' L U' L' U2 L

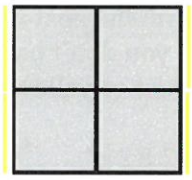


Right Soon = R U R' U R U2 R'

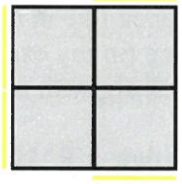


These next 5 cases require 2 or more Soon algorithms.

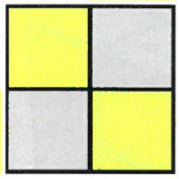
Right Soon



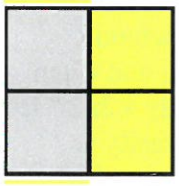
Right Soon



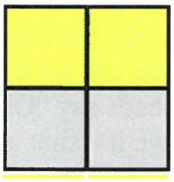
Right Soon



Right Soon



Right Soon



Now with what I have taught you, your cube should look something like this one. Now, don't forget to practice, practice, practice up to this step or else you might forget. You're almost finished solving your 2x2 now, there's only one step left. Luckily for you, this next step only requires memorizing one more algorithm except this alg is a bit trickier than the previous ones.