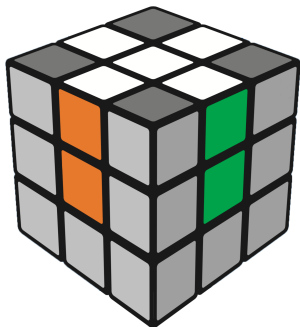


3x3 Rubik's cube solution

Step 1 – Build white cross on top layer:



Algorithm: **F' U L' U'**

- Position cube so white center is on top
- Decide on target color #1 (either red, orange, blue, or green), and reposition the cube so that that color is in the front layer
- Find the edge piece that is white & color #1
- Move that piece to the center of the bottom layer, with color #1 on the front face and white below on bottom face (ideally)
- Rotate front layer 2 times to place piece in correct location on top
- If colors are reversed, use algorithm to reverse them: **F' U L' U'**

Step 2 – Build entire white layer:



Algorithm: **R' D' R D**

- Identify top corner to complete and reposition cube so the corner is the lower-right corner of top layer
- Move corresponding white corner piece (with respective 2 side colors) to bottom layer and position below target corner
- Use algorithm **R' D' R D** as many times as necessary to position corner piece correctly in target corner (on top layer)
- Repeat above 3 steps for remaining 3 corners
- If white corner piece is in the top layer but wrong corner, use **R' D' R D** one time to place corner piece in bottom layer, then reposition to below correct corner

Step 3 – Complete middle layer:



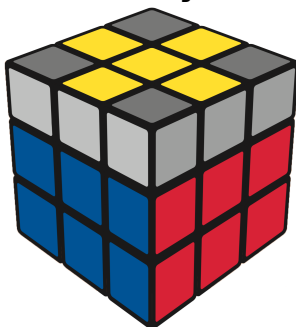
Algorithms:

Right: **U R U' R' U' F' U F**

Left: **U' L' U L U F U' F'**

- Flip cube so yellow center becomes the top layer
- Identify an edge piece on top layer that does not have yellow
- Identify the side color of that edge piece and rotate top layer so that the edge piece's side color matches the corresponding center piece color and reposition cube with center piece in front
- Identify the edge piece's color on the top layer; the matching center color will either be on the left layer or the right layer. Use these algorithms to move edge piece to either the left or right:
 - Right: **U R U' R' U' F' U F**
 - Left: **U' L' U L U F U' F'**
- If an edge piece is in the middle layer with wrong orientation, use one of the above algorithms to get it to the top layer, then rotate top layer and find matching center color, and repeat above steps.

Step 4 – Build yellow cross:

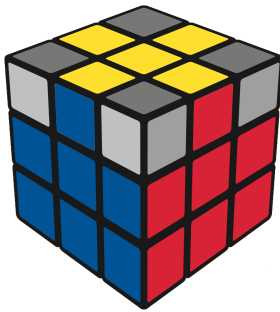


Algorithm: **F R U R' U' F'**

- Position cube so yellow center becomes the top layer
- Identify starting case from list below
- Apply algorithm: **F R U R' U' F'**
- 3 possible cases:
 - Case 1: Yellow dot

- Do algorithm one time to get yellow L shape
- Rotate top to position L shape in upper left of top layer
- Do algorithm one time to get yellow line (3 pieces)
- Align yellow line from left to right
- Do algorithm to get yellow cross
- Case 2: Yellow L shape
 - Repeat algorithm two times (see above steps)
- Case 3: Yellow line (3 pieces)
 - Do algorithm one time (see above steps)

Step 5 – Complete yellow cross by adding edge pieces:

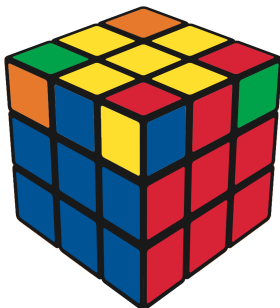


Algorithm: **R U R' U R U² R'**

- Preparation: Rotate top layer to identify case:
- 2 possible cases:
 - Case 1: Two adjacent sides line up
 - Position those sides on back and right
 - Do algorithm: **R U R' U R U² R'**
 - Case 2: Two opposite sides line up (rare)
 - Position those sides on front and back
 - Do algorithm: **R U R' U R U² R'**
 - Identify to adjacent sides that will now line up
 - Position those sides on back and right
 - Do algorithm: **R U R' U R U² R'** (max times = 3)

Completion: rotate top layer to line up all four edge pieces

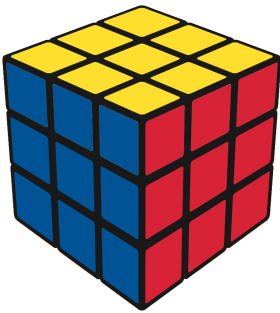
Step 6 – Get all four corner pieces in correct positions



Algorithm: **U R U' L' U R' U' L**

- Identify a corner piece that is in its correct position. (NB. If all corner pieces are not in correct positions, do algorithm: **U R U' L' U R' U' L** and identify corner (as above))
- Reposition cube so that that corner piece is in Front Right corner (of top layer)
- Do algorithm: **U R U' L' U R' U' L**
- If all four corner pieces are not yet in their correct positions, repeat algorithm. *NB*: Corner pieces do not need to be properly lined up in this step

Step 7 – Complete solution process



Algorithm: **R' D' R D**

- Identify a corner piece that is not properly lined up
- Reposition cube so that the corner piece is in the Front-Right
- Do: **R' D' R D** as many times as necessary for corner piece to get correctly lined up. Note middle and bottom layers may appear scrambled
- Keep cube in the same position (very important)
- Rotate top layer (CCW) until next corner piece that needs to be correctly lined up arrives in Front-Right corner
- Do: **R' D' R D** as many times as necessary for corner piece to get correctly lined up (*NB*. can require as many as four times).
- If not completely solved, rotate top layer (CCW) again as above & repeat until solved. (*NB*. Once solved, top layer may need to be rotated for final alignment).

References

Z3Cubing:

- [youtube.com/watch?v=rJlh5p2wAKA](https://www.youtube.com/watch?v=rJlh5p2wAKA)
- worldcubeassociation.org/persons/2014WALK05