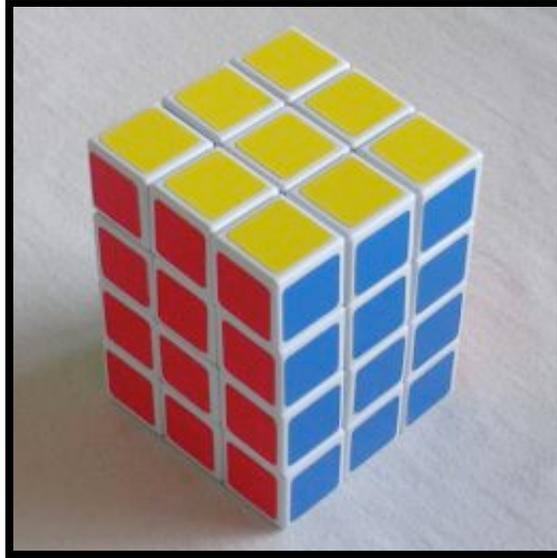


## 3×3×4



This puzzle is like a 3×3×4 Rubik's cube. The two 3×3 faces and middle layers can be turned by quarter or half turns, but the four 3×4 faces only allow half turns. It is made by Cube 4 You.

### The number of positions:

There are 8 corners and 8 edges in the outer layers, and similarly 8 edge pieces and 8 centres in the inner layers. None of the pieces can be twisted or flipped in place. This leads to a maximum of  $8!^4$  positions, but this maximum is not reached because:

- There are 4 pairs of indistinguishable middle layer centres ( $2^4$ )
- The orientation of the puzzle as a whole does not matter (4)

The last factor is due to there not being any fixed reference point to distinguish the sides. Note also that even though the edges of the middle layers seem to come in identical pairs, they can be distinguished by their apparent orientation because they cannot actually be flipped. This gives a total of  $8!^4 / (4 \cdot 2^4) = 41,295,442,083,840,000$  positions.

### Notation:

Hold the puzzle with the square faces at the top and bottom. Clockwise quarter turns of the top or bottom layer will be denoted by U and D respectively, half turns by U2 and D2, and finally counter-clockwise turns by U' and D'. Turns of the upper and lower middle layers will be denoted in the same way, except that the lower case letters u and d are used. For the side faces the letters F, B, L, and R represent half turns of the front, back, left and right face respectively.

### Solution:

**Phase 1:** Solve the top and bottom layer corners.

- a. First put the corners in their correct layer. It is easy to get it so that there is only one corner in each layer

- that is out of place. To correct those final corners, hold the puzzle so that the incorrect top corner is at the front right, and turn the bottom layer so that its wrong corner is at the bottom left, and then do R D R.
- Now examine the side colours of the top layer corners to see which pieces need to be swapped to make the sides match. At most one pair needs to be swapped.
  - To swap adjacent corners, put the corners at the front right and front left, and do: F U' F U F R U R U' R
  - To swap diagonally opposite corners, put the corners at the front right and back left, and do: R U<sup>2</sup> F U R U<sup>2</sup> F U' R U<sup>2</sup> F
  - The top layer corners should now be solved. Turn over the puzzle so that the bottom layer becomes the top layer, and do steps b-d to solve those corners as well.

**Phase 2:** Solve the top and bottom layer edges.

- First put the edges in their correct layer. Turn the top and bottom layers so that both have an incorrect edge piece at the front, and do U<sup>2</sup> RFR U<sup>2</sup> RFR. Repeat this until all the edges are in their correct layers.
- Now examine the side colours of the top layer edges to see which pieces need to be swapped to make the sides match the corners.
- To swap adjacent edges, put the edges at the front and the right, and do: R D B R U<sup>2</sup> R U<sup>2</sup> R U<sup>2</sup> B D' R
- To swap opposite edges, put the edges at the front and the back, and do: R U<sup>2</sup> R U<sup>2</sup> R
- Repeat b-d until the top layer edges are solved.
- Turn over the puzzle so that the bottom layer becomes the top layer, and do steps b-e to solve those edges at well.

**Phase 3:** Solve the middle layer edges.

- First put the edges in their correct layer. To recognize whether an edge is in the right layer or not, turn the layer until its colours match those of an adjacent outer layer corner. If the colours match exactly then it is in the correct layer, but if its colours are swapped then it is incorrect. Turn u until an incorrect edge is at the front right, turn d until an incorrect edge is at the front left, and then do R d R to swap them. Repeat this until all the edges are in their correct layers.
- Turn u to put at least two of its edges correct. At most one pair needs to be swapped.
- To swap adjacent edges, hold the puzzle so that the incorrect edges are at the front right and front left, and do: u' R u R d' R d R F d F
- To swap diagonally opposite edges, hold the puzzle so that the incorrect edges at the front right and back left, and do: R u<sup>2</sup> F u' R u d R d' F u<sup>2</sup> R u'
- The u layer edges should now be solved. Turn over the puzzle so that the bottom layer becomes the top layer, and do steps b-d to solve the other middle layer's edges as well.

**Phase 4:** Solve the middle layer centres.

- Choose two centre pieces that you would like to swap. Hold the puzzle so that one lies in the back face, and the other on the left or front.
- Do one of the following to swap the two pieces:
  - To swap Bu and Lu, do: R F L d L F R u
  - To swap Bd and Ld, do: R F L u L F R d
  - To swap Bd and Lu, do: u' R F L d' L F R
  - To swap Bu and Ld, do: d' R F L u' L F R
  - To swap Bu and Fu, do: R F L d<sup>2</sup> L F R u<sup>2</sup>
  - To swap Bd and Fd, do: R F L u<sup>2</sup> L F R d<sup>2</sup>
  - To swap Bd and Fu, do: u<sup>2</sup> R F L d<sup>2</sup> L F R
  - To swap Bu and Fd, do: d<sup>2</sup> R F L u<sup>2</sup> L F R
- Repeat a-b until the centres are all solved.

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