CFOP(Cross/F2L/OLL/PLL)
LBL(Layer By Layer)

STEP1: White cross
STEP2: Good white cross
STEP3: Good white face
STEP4: Bottom two layers
STEP5: Yellow cross
STEP6: Yellow face
STEP7: Top layer corner
STEP8: Finishing

Center-piece
2-color-piece
3-color-piece

Difficulty:
Difficult
Extremely Difficult
Easy
STEP 1: White cross

• Build a white cross at this step. Not need to care the 3-color-pieces (corner)
• Hold the cube so that WHITE center-piece faces upward.

① **LUCKY** if the bottom has WHITE 2-color pieces. Turn 180°

② If WHITE 2-color-piece is in middle layer, firstly, turn middle layer and move up to make a shoulder of white cross.

③ **UNLUCKY** if the top layer or bottom layer has WHITE 2-color-piece. Turn it 90° to change the state to ② above
STEP2: Good white cross

- WHITE center-piece must face upward, again.
  ① Find a face where top layer 2-color piece and middle layer center-piece do not correspond

  ![Not correspond](image)
  ![Correspond](image)

  FRONT

  ② Keep holding the cube as shown right until STEP2 ends. (FRONT and top two layers can be turned)

  ③ Turn FRONT 180° (Up-side-down)

  ![Up-side-down](image)

  ④ Turn middle and top layers together so that base layer matches center color (MATCH)

  ![MATCH](image)

【NOTE】
- During the repetition of ③ and ④, white cross is deformed.
- During the repetition of ③ and ④, do not move the finger of ②.

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STEP3: Good white face

- WHITE center-piece must face upward, again.
  ① Find WHITE 3-color-piece in Base layer
  ② Turn base layer so that the found WHITE 3-color-piece of ① is placed between the SAME colored center-pieces

③ Based on the state of WHITE face of 3-color-piece, conduct one of the algorithm below.

(1) **Right base** (WHITE faces you)

(2) **Left base** (WHITE faces you)

(3) **Right bottom** (WHITE faces downward)

[Exception] As seen in the left figure, in case a 3-color-piece is orientation-wrongly placed in top layer and no WHITE 3-color-piece exists in base layer, move any of NON-WHITE 3-color-piece to the place and kick away the WHITE 3-color-piece to base layer.
STEP 4: Bottom two layers

- Turn whole cube 180° so that YELLOW center-piece faces upwards
  ① Find NON-YELLOW 2-color-piece in top layer.
  ② Turn top layer so that the found color corresponds to the color of center-piece (Make up-side-down T shape)

③ Compare the color upward of the corresponding 2-color-piece and the center-pieces of left/right face.

Color upward corresponds to **RIGHT** center-piece

Color upward corresponds to **LEFT** center-piece

[EXCEPTION] In case 2-color-piece is orientation-wrongly placed in middle layer and no NON-YELLOW 2-color-piece exists in top layer, move any of YELLOW 2-color-piece to the place and kick away the orientation-wrongly placed piece by using the algorithm above.
STEP 5: Yellow cross

- Hold the cube so that YELLOW center-piece faces upward.

① Identify the YELLOW pattern at the top face (Hold correctly in the case of L-shape or Lucky I-shape).

① Repeat algorithm below until Yellow cross appears:

\[ F \rightarrow R \rightarrow U \rightarrow R' \rightarrow U' \rightarrow F' \]
STEP 6: Yellow face

1. Hold the cube so that YELLOW center-piece faces upward
2. Identify the YELLOW pattern at the top face (Confirm color at sides, too)

Repeat the algorithm below until YELLOW FACE appears:

**Near side**
- FAN B
- EIGHT
- FAN A

**Far side**
- CROSS A
- FISH
- LUCKY FISH
- YELLOW FACE

**Algorithm:**
- R
- U
- R'
- U
- R

180°
STEP7: Top Layer Corner

① Count the number of pairs at the YELLOW corners

(1) Four PAIRS  (2) One PAIR  (3) Zero PAIR

Move to STEP 8

HOLD
YELLOW face upward
PAIR leftward
and do algorithm below
→ Move to (2)

R
U
R'
U'
R'
F
R2

U'
R'
U'
R
U
R'
F'

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**STEP 8: Finishing**

① Count the number of completed faces

- **(1) 6 faces OK**
  - **HOLD**
  - YELLOW face **upward**
  - OK face **farside**
  - and do algorithm below
  - (Repeat, if not complete)

- **(2) 3 faces NG**
  - MOVE to (2)

- **(3) 4 faces NG**
  - MOVE to (2)

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**Initial**

- Hold
- **YELLOW face upward**
- **OK face farside**
- and do algorithm below
- (Repeat, if not complete)

**Goal**

**Finish!**
Unlucky case in STEP 3

【OK】完全一面

アンラッキー１
白の向きが違う（A）
側面の色が違う（C）
※底面に白い部品がない

アンラッキー２
側面の色が違う（B）
※底面に白い部品がない

(1) 右下（白は手前を向いている）
上二段
(D)又は(B)の時
（2）左下（白は手前を向いている）
下二段
(C)の時
白色の部品が底面に移動

Unlucky case in STEP 4

【OK】下二段

アンラッキー3
向きが違う（D）
※上面をいくら回しても逆Tを作れない状態

アンラッキー4
違う位置にハマる【左】（E）
違う位置にハマる【右】（F）

(D)又は(F)の時
違う位置にハマる【左】（E）
違う位置にハマる【右】（F）

逆Tを作れる部品が上面へ

又は
上面の色と右の中心部品の色が同じ場合

上面の色と左の中心部品の色が同じ場合
"Never finished state (called parity)" could be happened after re-constructing the removed parts of cube. In this case, the best solution to fix this problem is to dissemble the all parts of cube and re-construct it.

Orientation of 3-color-part is wrong

Positions of 2-color-part are switched

Do not bring your cube to your school, unless your teacher allows you to do so.
A little introduction of intermediate techniques…

**STEP5**

Intermediate algorithm enable to skip one process of algorithm in STEP 5 (The difference is the first and last movement)

![Diagram of STEP 5]

**STEP1 and 2**

After getting used to movement of Rubik’s cube, try to skip STEP 1 (white cross) and complete STEP 2 (good white cross) directly. This is the best technique to reduce the amount of 6 face finishing time.