CFOP(C~ross~/F2L/OLL/PLL) LBL(Layer By Layer)
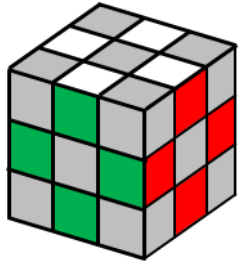
Difficulty
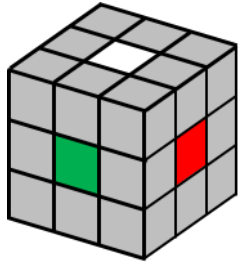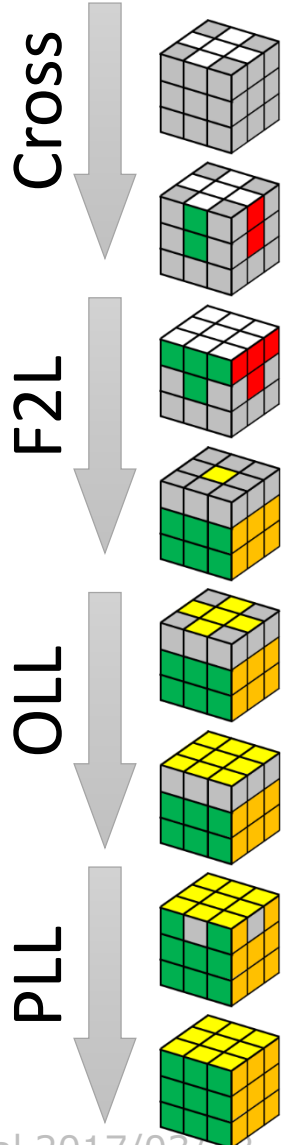
Center-piece

2-color-piece
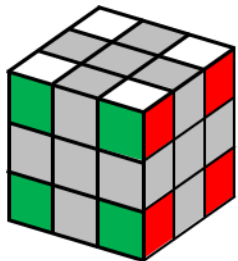
3-color-piece

Cross

STEP1:White cross — Difficult

STEP2:Good white cross — Difficult

F2L

STEP3:Good white face — Extremely Difficult

STEP4:Bottom two layers — Extremely Difficult

OLL

STEP5:Yellow cross — Easy

STEP6:Yellow face — Easy
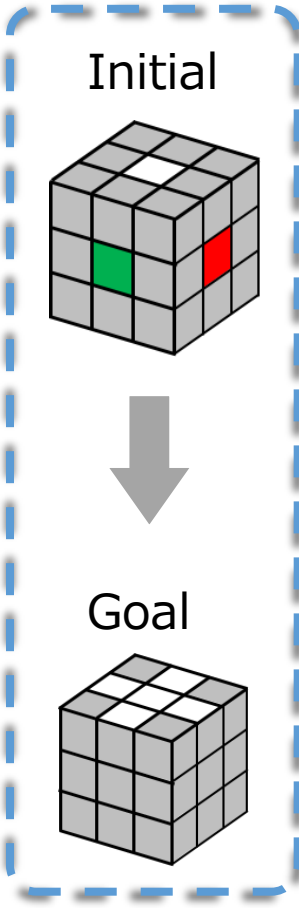
PLL

STEP7:Top layer corner — Easy
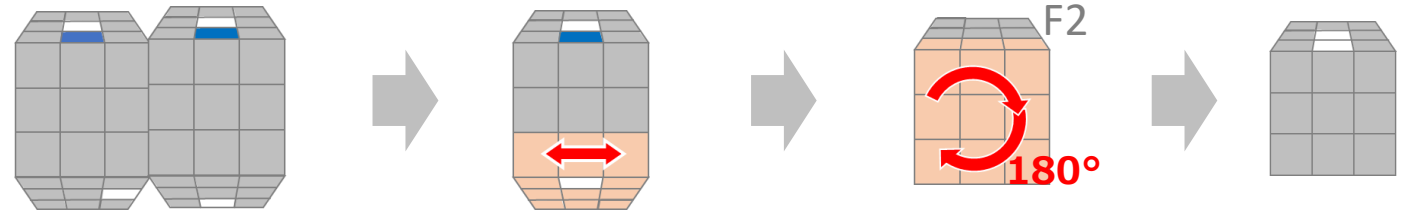
STEP8:Finishing — Easy

STEP1：White cross

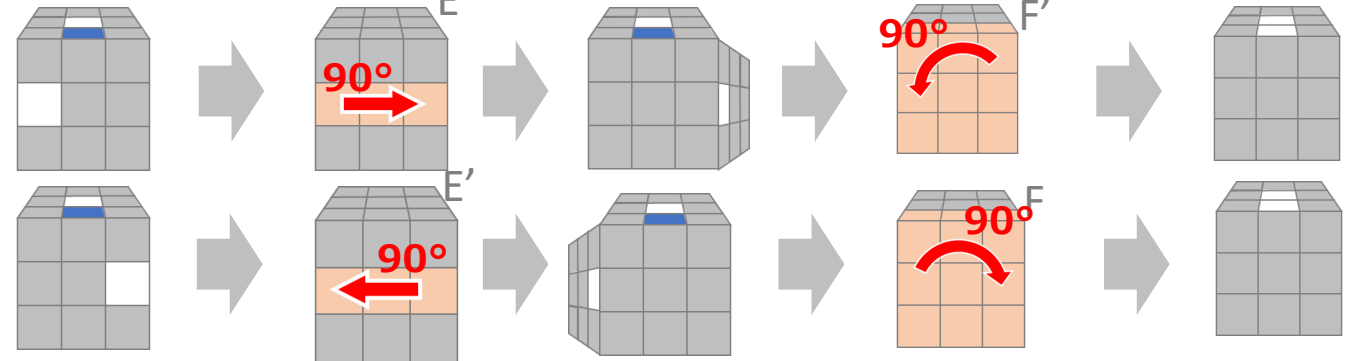- Build a white cross at this step. Not need to care the 3-color-pieces (corner)
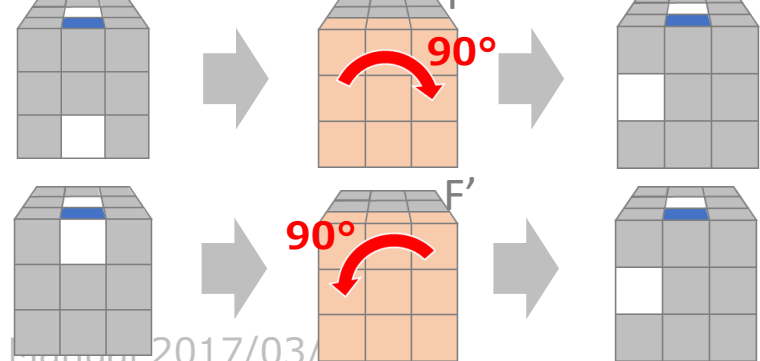- Hold the cube so that WHITE center-piece faces upward.

Initial

Goal

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

F2

180°

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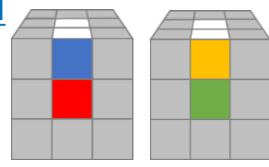
E

90°

F'

90°

E'

90°

F

90°

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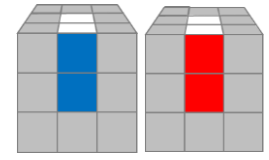
F

90°

F'

90°

STEP2:Good white cross

- WHITE center-piece must face upward, again.

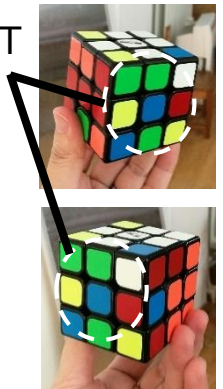 ① Find a face where top layer 2-color piece and middle layer center-piece do not correspond

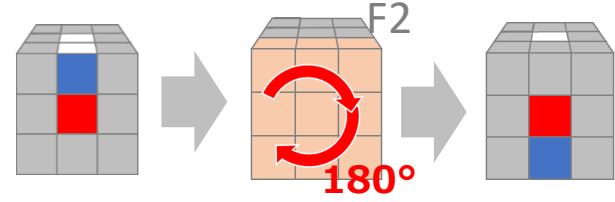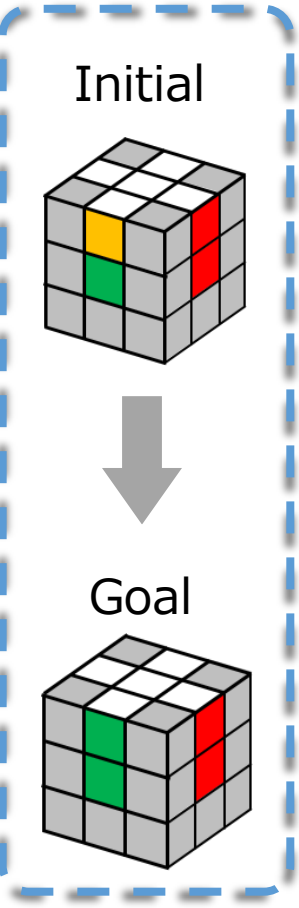 **Not correspond**   **Correspond**   FRONT

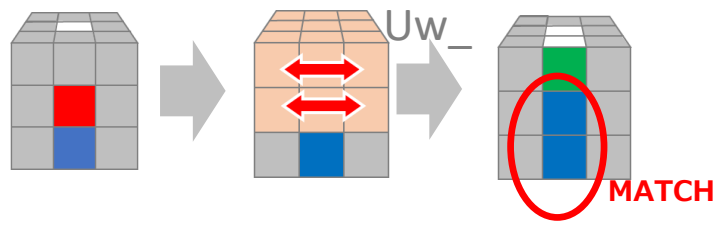## Initial

Goal

Up-side-down

Until good white cross

MATCH

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

③Turn FRONT 180° (**Up-side-down**)

F2

180°

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

Uw_

MATCH

【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.

STEP3:Good white face

- • WHITE center-piece must face upward, again.

①Find WHITE 3-color-piece in Base layer

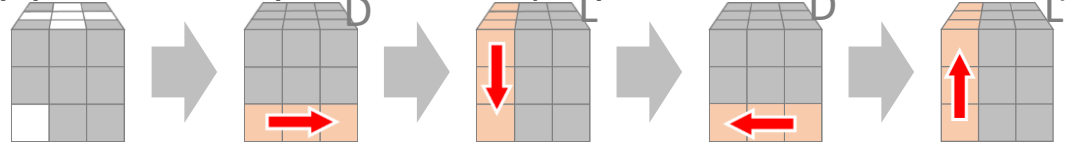②Turn base layer so that the found WHITE 3-color-piece of ① is **placed between** the SAME colored center-pieces

OK!　　　　　　　　　**NG!**

Place between

×4

TURN

Initial

Goal
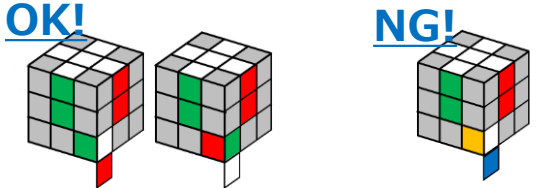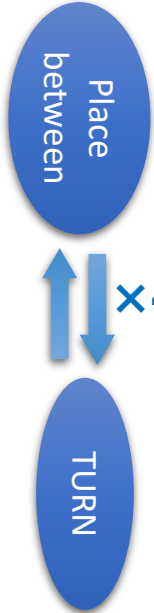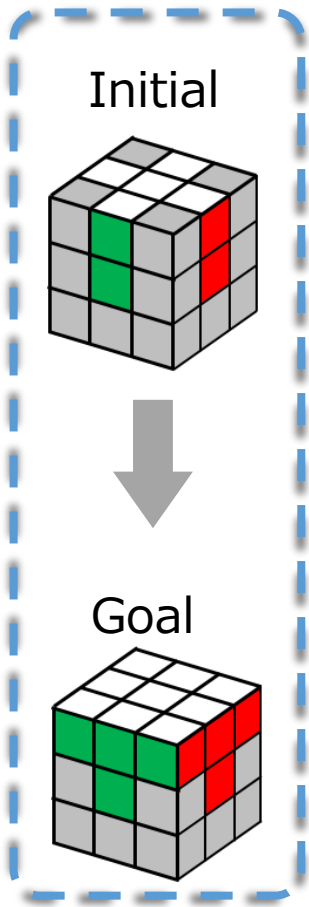
③Based on the state of WHITE face of 3-color-piece, conduct one of the algorithm below.
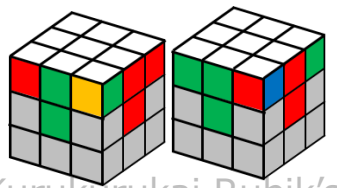
(1) **Right base** (WHITE faces you)

D'　R'　D　R
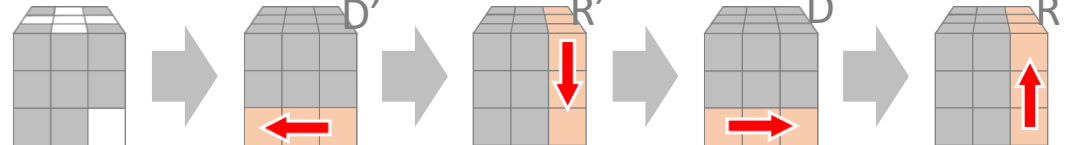
(2) **Left base** (WHITE faces you)

D　L　D'　L'

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

R'　D2　R　D

180°　(2)
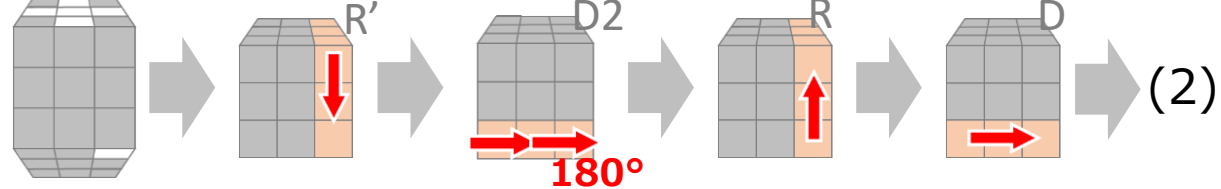
NG!

[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.
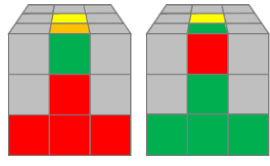
STEP4:Bottom two layers

Initial

Goal

Up-side-down T

×4

TURN

- Turn whole cube 180° so that YELLOW center-piece faces upwards
  ①Find NON-YELLOW 2-color-piece in top layer.

  ②Turn top layer so that the found color corresponds to the color of center-piece (Make **up-side-down T** shape)
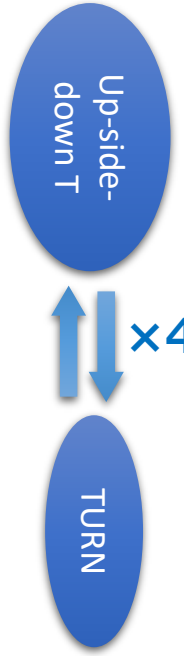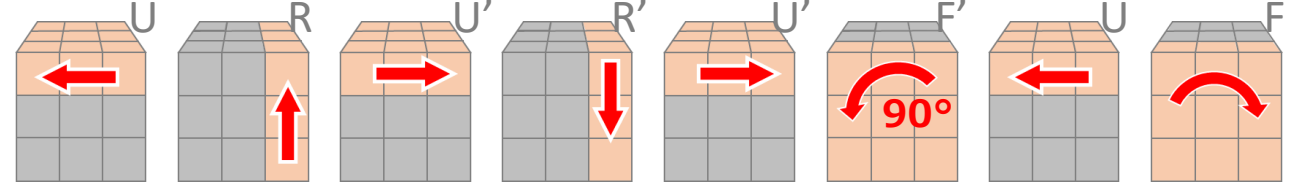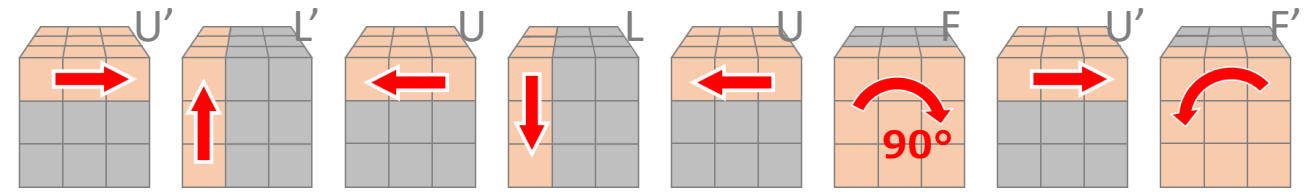
OK!　　　　　　　　　　　**NG!**
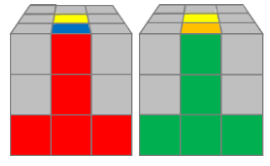
③Compare the color upward of the corresponding 2-color-piece and the center-pieces of left/right face.
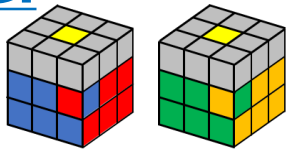
Color upward corresponds to **RIGHT** center-piece

U　　R　　U'　　R'　　U'　　F'　　U　　F

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

U'　　L'　　U　　L　　U　　F　　U'　　F'

90°　　　　　　　90°

NG!

[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.
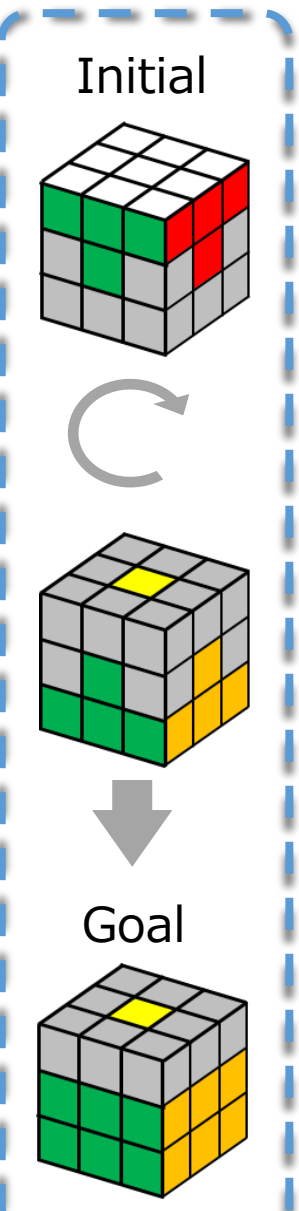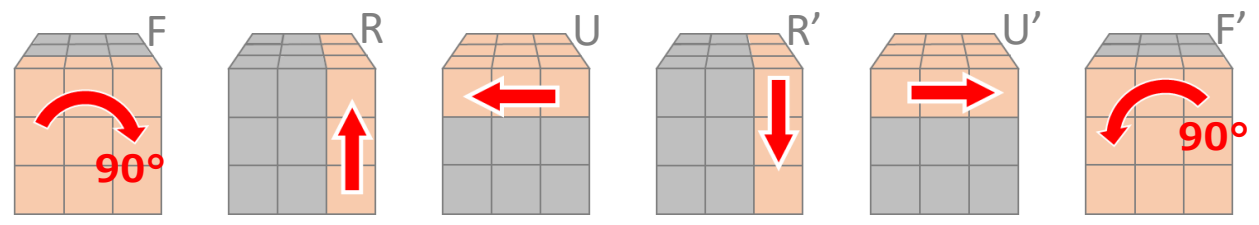
STEP5:Yellow cross

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

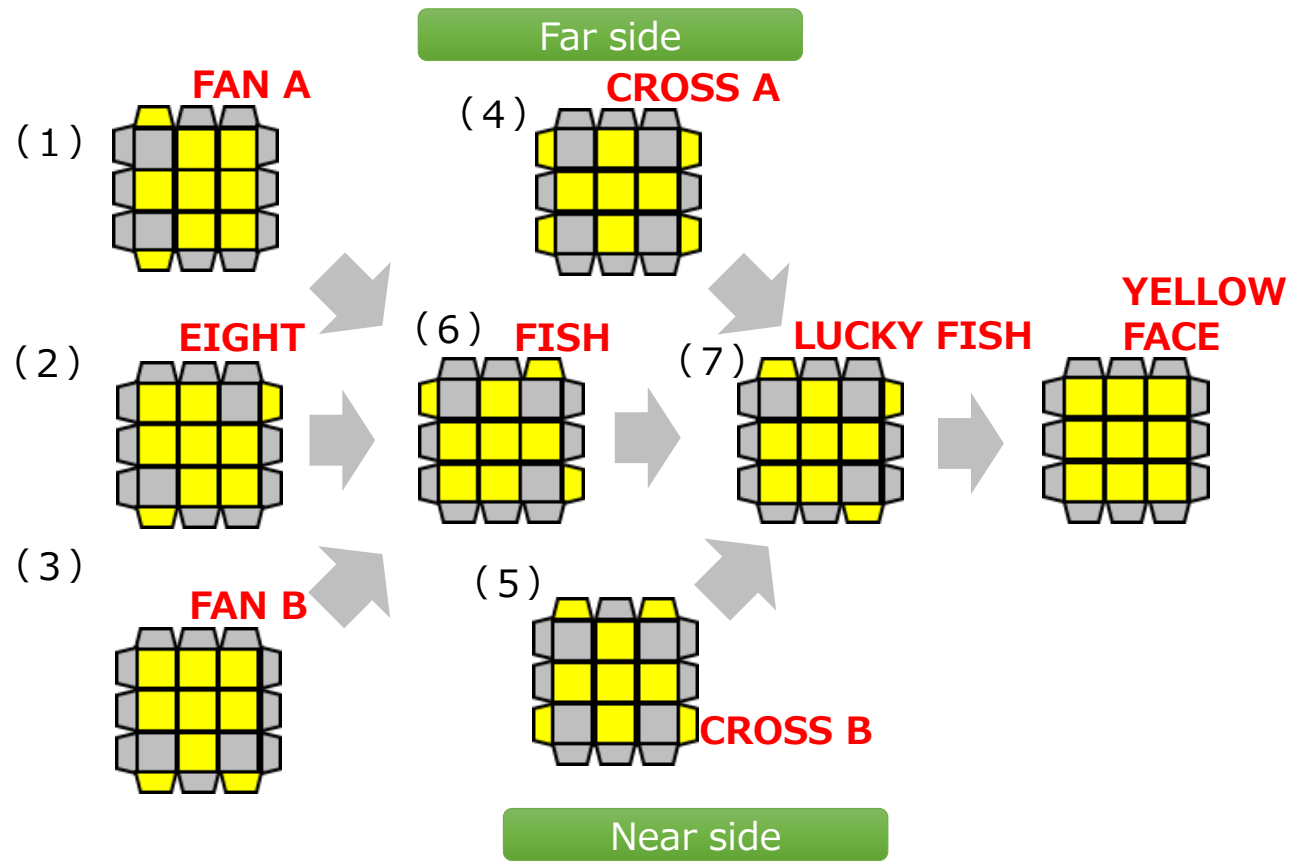①Identify the YELLOW pattern at the top face (Hold correctly in the case of L-shape or Lucky I-shape)

Far side

DOT → **L-shape** → **Lucky minus-shape** → **Yellow cross**

Near side
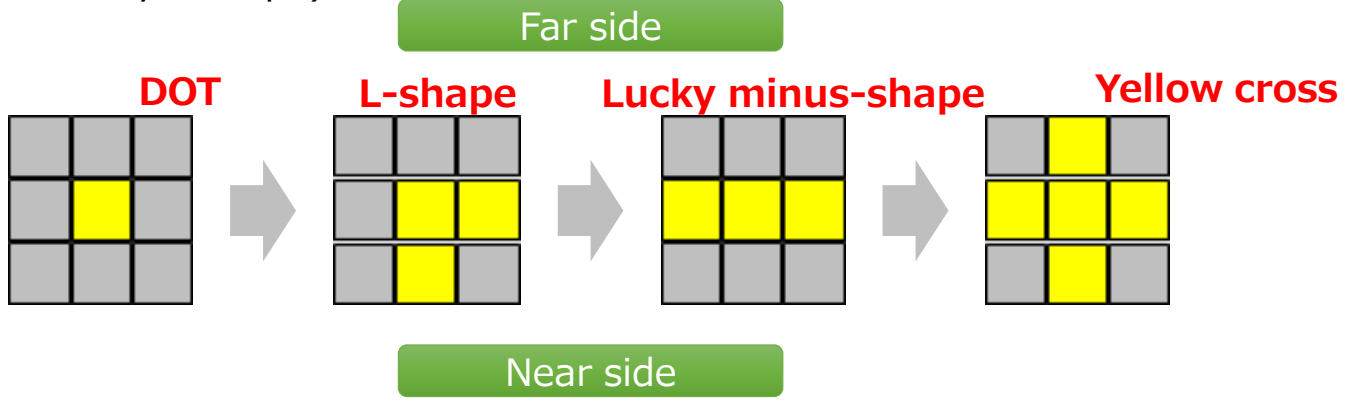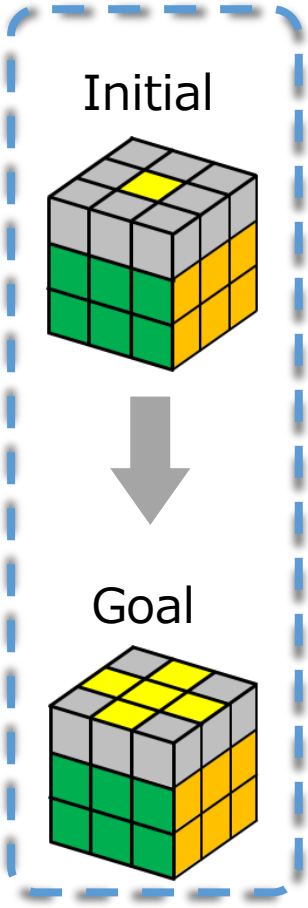
①Repeat algorithm below until Yellow cross appears
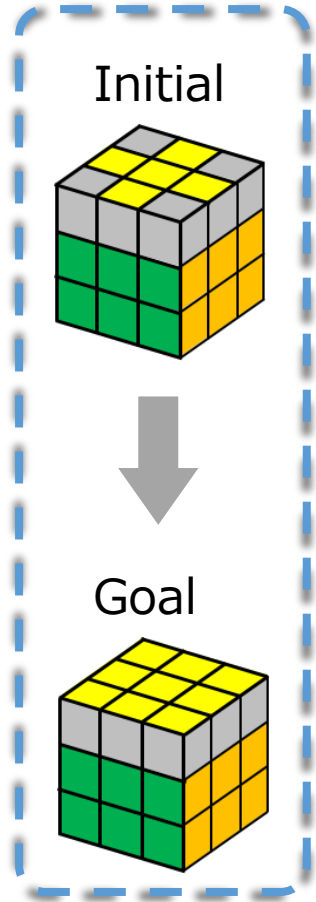
F R U R' U' F'

90° 90°

Initial

Goal

STEP6：Yellow face

Initial

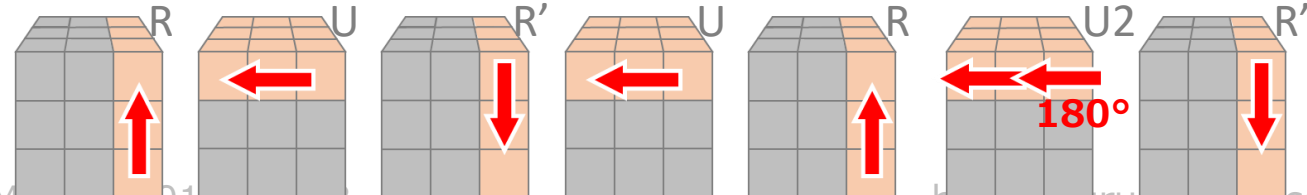Goal

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

Far side
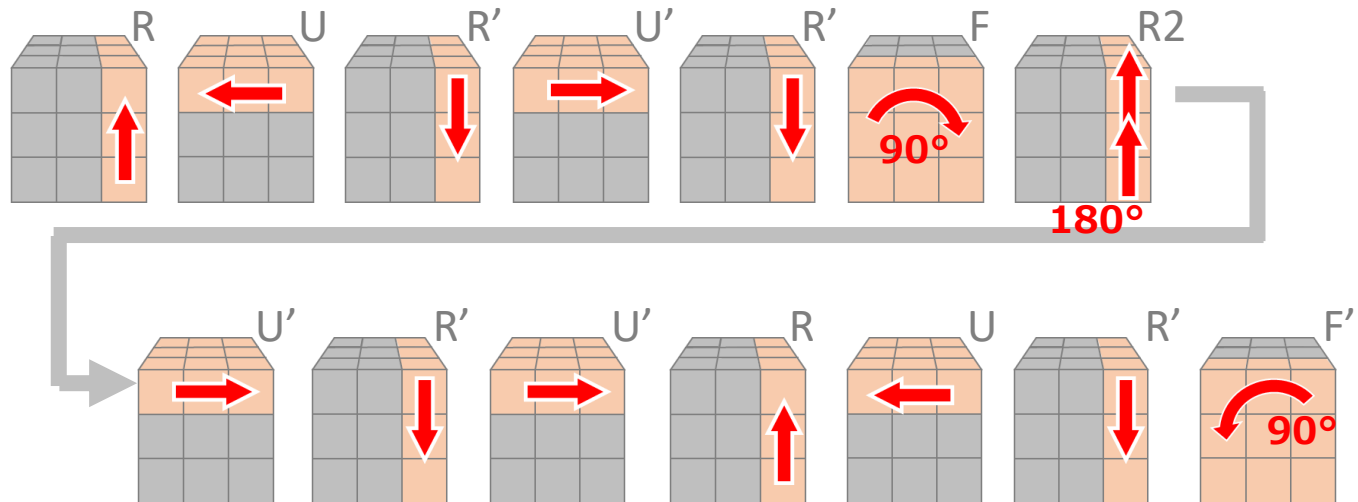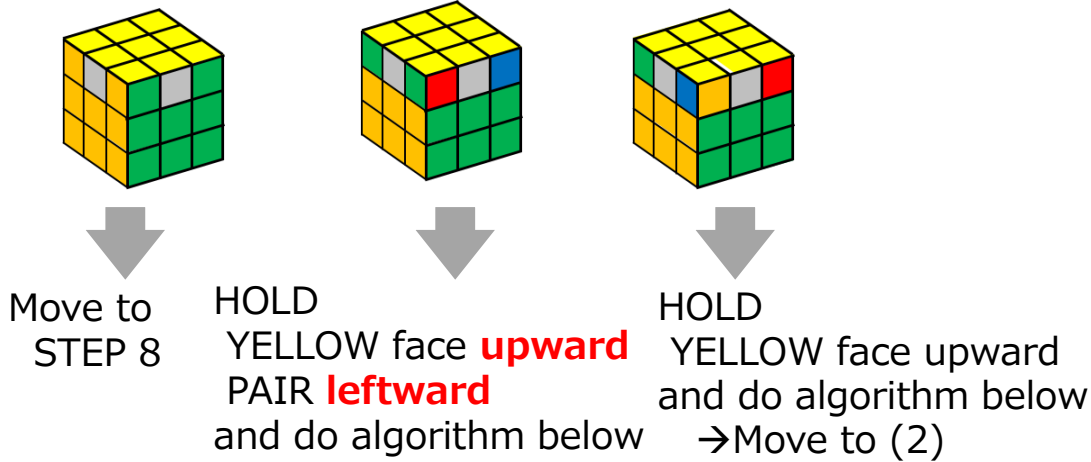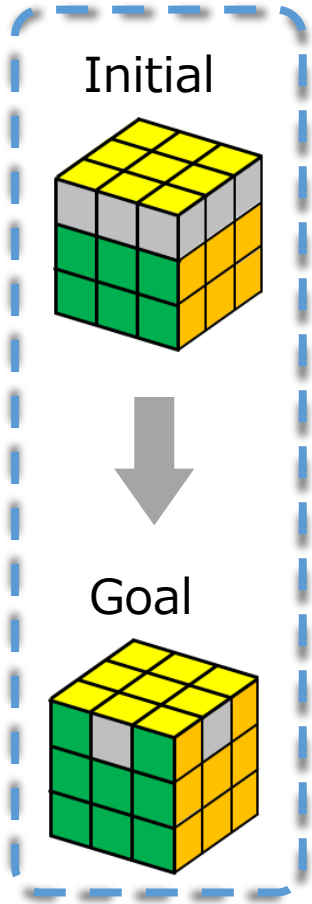
FAN A
（1）

CROSS A
（4）

EIGHT
（2）

FISH
（6）

LUCKY FISH
（7）

YELLOW FACE

FAN B
（3）

CROSS B
（5）

Near side

②Repeat the algorithm below until YELLOW FACE appears

R   U   R'   U   R   U2   R'

180°

STEP7:Top Layer Corner

①Count the number of pairs at the YELLOW corners

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

Initial

Goal

Move to STEP 8

HOLD
YELLOW face **upward**
PAIR **leftward**
and do algorithm below

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

R U R' U' R' F R2

90° 180°

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

90°

STEP8：Finishing

①Count the number of completed faces
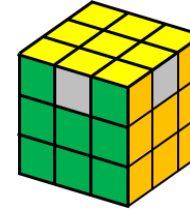
Initial

Goal
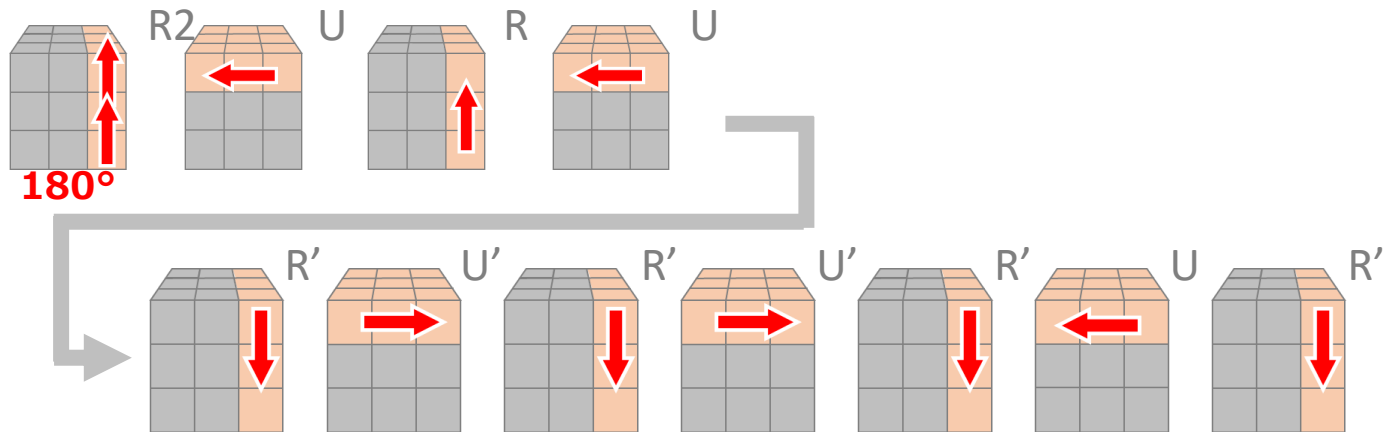
Finish!
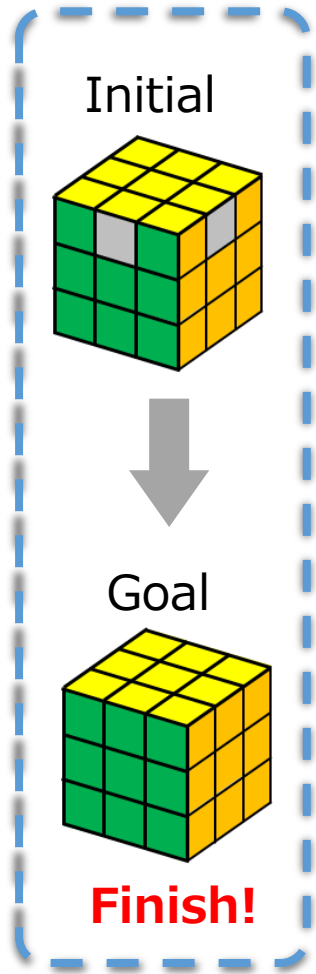
(1)6 faces OK

COMPLETE!

(2)3 faces NG

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

(3)4 faces NG

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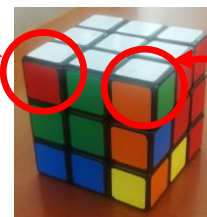 YELLOW face **upward**
and do algorithm below
→Move to (2)

180°   R2   U   R   U

R'   U'   R'   U'   R'   U   R'

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）

※底面に白い部品がない

アンラッキー 2

側面の色が違う
（C）

側面の色が違う
（B）

※底面に白い部品がない

(A)又は(B)の時

（1）**右下**（白は**手前**を向いている）

D' R' D R

白い部品が底面に移動

(C)の時

（2）**左下**（白は**手前**を向いている）

D L D' L'
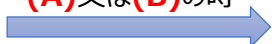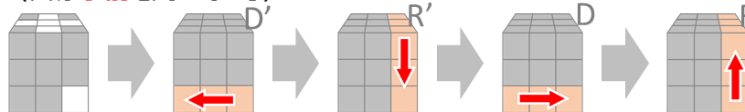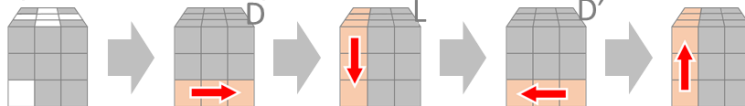
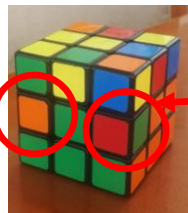# Unlucky case in STEP 4

【OK】下二段

アンラッキー3

※上面をいくら回しても
逆Tが作れない状態

向きが違う
（D）

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

上面の色と**右の中心部品**の色が同じ場合

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

逆Tを作れる部品が上面へ

(E)の時

上面の色と**左の中心部品**の色が同じ場合

U' L' U L U F U' F'
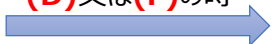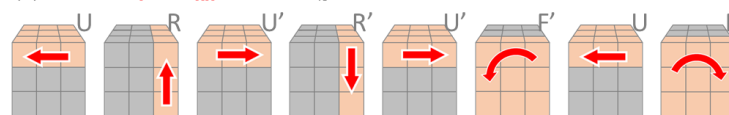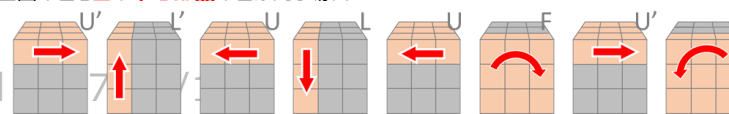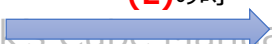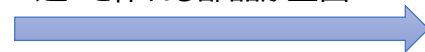
"Never finished state (called parity)" could be happened after re-constructing the removed parts of cube.   In this case, the best solution to fix this problem is to dissemble the all parts of cube and re-construct it

Orientation of 3-color-part is wrong
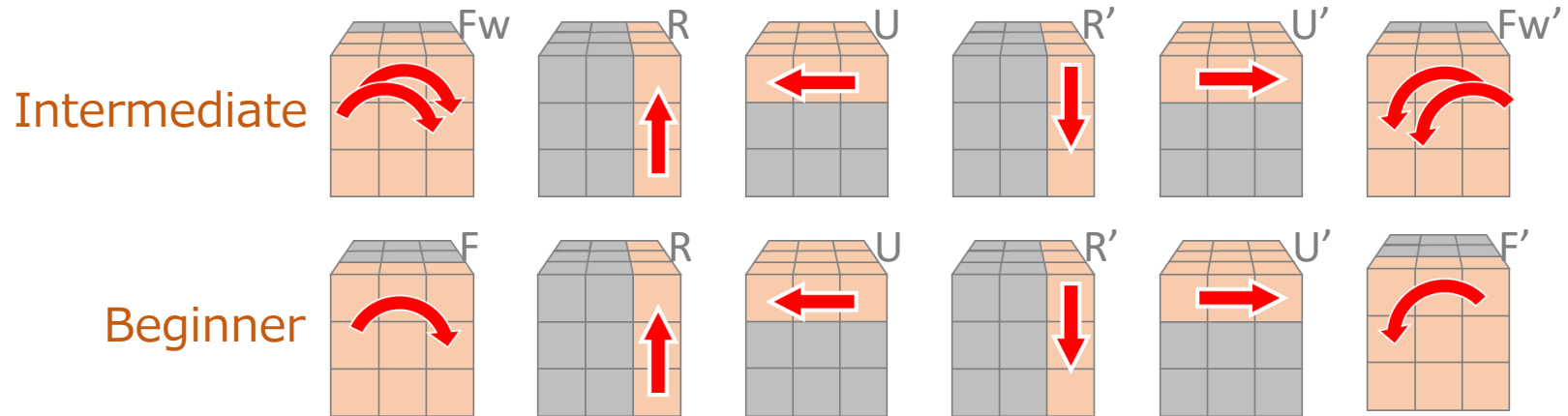

Positions of 2-color-part are switched

note 2

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)

Intermediate: Fw R U R' U' Fw'

Beginner: F R U R' U' F'

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.