

RUBIKCUBE

RUBIKCB

8/25/94

## 1. "FACE" Designations

## 2. Rotation Commands (always with face being rotated toward you.)

- F 1. Rotate F face  $\frac{1}{4}$  turn clockwise  
R 2. Rotates R face  $\frac{1}{2}$  turn (clockwise or counterclockwise)  
B - Rotates B face  $\frac{1}{4}$  Turn counterclockwise  
X returns to menu.

④ 3 F<sub>2</sub>, U, R-, B, D-, L<sub>2</sub>, X      PC = 1  
manual moves

| F     | R     | B     | PC = 2        |
|-------|-------|-------|---------------|
| O R W | Y R G | B B Y | Face displays |
| O G W | Y R B | Y Y G | after manual  |
| B R D | Y Y O | W D R | moves.        |

| U     | L     | D     |
|-------|-------|-------|
| B R R | W G G | R G O |
| B W Y | W W W | W B O |
| B W D | G G Y | W B G |

Cube Solved

PC = 3 Automatic Solve

135 moves

Cube solved (Check each move using  
PC = 2 - ok.)

| F     | R     | L     | B     | U     |
|-------|-------|-------|-------|-------|
| Y R W | G B R | Y G B | Y W R | W Y W |
| G G G | R R R | W W W | Y Y Y | W W Y |
| G G G | R R G | W W W | B B Y | R W R |

Things to do:

1. Debug ④
2. Add  $\rightarrow$  command to subprograms  
2500 up.

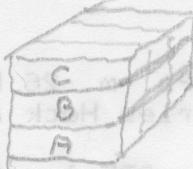
40457

5935

M31 = 2

RUBIKCB 25855 10-12-89 1:47P ④ F, U2, B-, D-

# RUBIK's CUBE



A - Bottom Layer

|   |   |   |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |

Element

4, 5, 1, 2, 3

Rotation

Clockwise

Counter-clockwise

Up

Down

Left

Right

Front

Back

Top

Bottom

Front-left

Front-right

Back-left

Back-right

Up-left

Up-right

Front-up

Front-down

Back-up

Back-down

Left-up

Left-down

Right-up

Right-down

Front-left-up

Front-left-down

Front-right-up

Front-right-down

Back-left-up

Back-left-down

Back-right-up

Back-right-down

Up-left-up

Up-left-down

Up-right-up

Up-right-down

Front-up-up

Front-up-down

Front-down-up

Front-down-down

Back-up-up

Back-up-down

Back-down-up

Back-down-down

Left-up-up

Left-up-down

Left-down-up

Left-down-down

Right-up-up

Right-up-down

Right-down-up

Right-down-down

Front-left-up-up

Front-left-up-down

Front-left-down-up

Front-left-down-down

Front-right-up-up

Front-right-up-down

Front-right-down-up

Front-right-down-down

Back-left-up-up

Back-left-up-down

Back-left-down-up

Back-left-down-down

Back-right-up-up

Back-right-up-down

Back-right-down-up

Back-right-down-down

Up-left-up-up

Up-left-up-down

Up-left-down-up

Up-left-down-down

Up-right-up-up

Up-right-up-down

Up-right-down-up

Up-right-down-down

Front-left-front-up-up

Front-left-front-up-down

Front-left-back-down-up

Front-left-back-down-down

Front-right-front-up-up

Front-right-front-up-down

Front-right-back-down-up

Front-right-back-down-down

Back-left-front-up-up

Back-left-front-up-down

Back-left-back-down-up

Back-left-back-down-down

Back-right-front-up-up

Back-right-front-up-down

Back-right-back-down-up

Back-right-back-down-down

Up-left-front-up-up

Up-left-front-up-down

Up-left-back-down-up

Up-left-back-down-down

Up-right-front-up-up

Up-right-front-up-down

Up-right-back-down-up

Up-right-back-down-down

Front-left-back-up-up

Front-left-back-up-down

Front-right-back-down-up

Front-right-back-down-down

Up-left-back-up-up

Up-left-back-up-down

Up-right-back-down-up

Up-right-back-down-down

Front-left-back-front-up-up

Front-left-back-front-up-down

Front-right-back-down-up

Front-right-back-down-down

Up-left-back-front-up-up

Up-left-back-front-up-down

Up-right-back-down-up

Up-right-back-down-down

Front-left-back-front-up-up

Front-left-back-front-up-down

Front-right-back-down-up

Front-right-back-down-down

|    |    |    |
|----|----|----|
| 25 | 26 | 27 |
| 22 | 23 | 24 |
| 19 | 20 | 21 |

## Color Code

- 1 - Green
- 2 - Red
- 3 - Yellow

- 4 - Orange
- 5 - Blue
- 7 - White
- Ø - Black

D(N,k) matrix is need to describe color make-up of each element of the cube where N = element # per adjoin charts

$$D(N,k) = \text{6 character code}$$

### Char #

- 1 Front face of element
- 2 Back face
- 3 Left face
- 4 Right face
- 5 Down face
- 6 Up face

Example (solved puzzle)

Note: elements are always viewed from front of puzzle i.e. green face (solved puzzle) as the F face, orange to Left and Red to right.

### Element

$$1 \quad D(6,1) = 104050$$

$$27 \quad D(2,1) = 030207$$

RUBIKCUB  
GW BASIC

SUB PROGRAMS

- 4100 - 4140      Constructs DD(N,1) & DD(N,2) Table  
                  from AA(x,y,z)
- 4200 - 4240      Constructs new AA(x,y,z) matrix  
                  and new DD(N,2) table  
                  from DD(N,1) table  
                  after a rotation.
- 4300 - 4306      AA(x,y,z) to color.  
                  Used in 4100 and 4200 subprograms.
- 4310 - 4317      Color to Code 2  
                  Used in 4100 and 4200 subprograms
- 4400 - 4450      PRINT FACE Display
- 5300 - 5700      Develop FACE display
- 6200 - 6450      Sets parameters for Rotation  
                  module and directs program  
                  for corner rotation and edge rotation
- 6500 - 6580      Corner rotation module
- 6600 - 6698      Master rotations module
- 6700 - 6780      Edge rotation module
- 7000 - 7060      Color to Color Codes

$$F_S^- = F B^-$$

$$F_S^- = F^- B$$

$F_m$  means moving the layer between  $F$  &  $B$  in the same direction as  $F$  moves the front face.

Pg 133 4x4

"There is an additional parity problem which can leave you needing to exchange just two edges ~~five~~ pieces.

Book Review taken over by CBS

Scientific American - March 81



### Recreations in mathematics

Rubik's Cubic Compendium by Rubik, Varga, etc

Dr David Singmaster - translated ~~and~~ edited by  
1987

Oxford University Press

Oxford New York Tokyo

Dr Singmaster an American  
teaches at the Polytechnic of the  
South Bank in London.

Newsletter - copies avail from D.S.  
Cubic Circular

Games & Puzzles

The moves shown in the  
following pages were  
not used in the computer  
program RUBIK.BAS

# Rubik's Cube

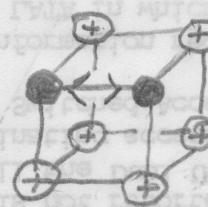
①

A. To Position Corners 2.6 Pg 47

1. Use  $(F T_c^{-1})^4 T$

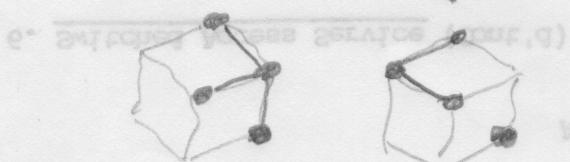
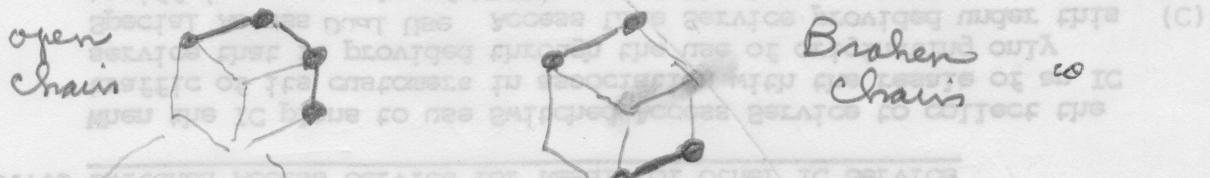
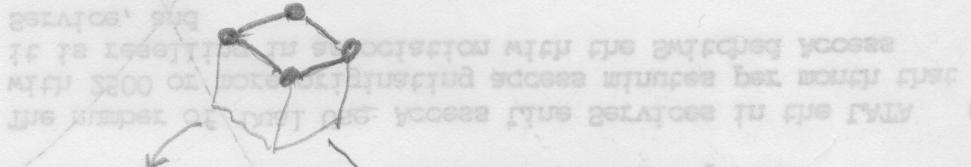


do this 4 times



2. or

a. Get 4 blue corners in a larger i.e closed chain



Branched chain

Branched off corner



Four separate corners

Use reverse to get to closed chain

2b To align the 4 blue corners with the center blue

- use



I.C T D (one example)  
= Tm

**Note:** Pg 51 It can be proved that no two cubes whether corners or edges can be moved without moving at least one other cube.

However it is possible to swap two corners and two edges at the same time while keeping all other cubes fixed.

The minimum number of cubes to leave their places is three: they may be either three corners or three edges.  $(F2 R_m)^4$  is an illustration

The move is the bottom of order: first take the left bottom corner and turn it clockwise. Then take the right bottom corner and turn it clockwise. Finally take the top bottom corner and turn it clockwise. This will align the bottom edge and the top edge. Now turn the bottom layer clockwise. This will align the middle edge and the top edge. Finally turn the top layer clockwise. This will align the top edge and the bottom edge.

This illustrates that a move of order 3 is required.

Another method is to take the bottom layer clockwise. Then take the middle layer clockwise. Finally take the top layer clockwise. This will align the bottom edge and the top edge. Now turn the bottom layer clockwise. This will align the middle edge and the top edge. Finally turn the top layer clockwise. This will align the top edge and the bottom edge.