

## Solving a Rubik's cube – A Mini-unit by Todd Thedell



### Goals:

- Learn about the history of the Rubik's cube.
- Solve the Upper layer
- Solve the Middle layer
- Solve the Lower layer
- Practice and share your skills with others.

### Facts:

5 cm x 5 cm x 5 cm cube made up of 26 smaller "cubes" with one of 6 colors facing out (White, Yellow, Red, Orange, Blue, Green)

Invented by Erno Rubik who was born in Budapest, Hungary during World War II. He was an architect and a teacher.

After he invented the cube in the spring of 1974, it took him a month to solve it. In 1977 he received a patent and the toy, the **Magic Cube**, was now available to the public. It was soon renamed after its inventor.

Japanese inventor, Terutoshi Ishige, applied a year after Rubik, for a Japanese patent on a very similar cube. An American, Larry Nichols, patented a cube before Rubik, held together with magnets. Nichols' toy was rejected by all toy companies, including the Ideal Toy Corporation, which later bought the rights to Rubik's Cube.

Erno Rubik has established a foundation to help promising inventors in Hungary. He was the first millionaire from a communist country.

### Solution:

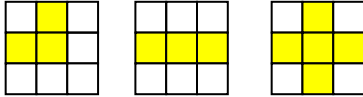
- There are 43,252,003,274,489,000 (43 quadrillion) different **possible** configurations but only one of these is correct.
- Centers are stationary; Corners and edges can be in any place.
- Six sides:

<b>Front</b>	<b>Right</b>	<b>Up</b>
<b>Back</b>	<b>Left</b>	<b>Down</b>
- Each of these faces can be move either Clockwise or Counterclockwise as if you were looking at it.
  - **F** = front clockwise, **f** = front counterclockwise
  - **R** = right clockwise, **r** = right counterclockwise
  - Etc.
  - **U**<sup>2</sup> = upper twice
- There are many methods for solving a cube, I will show you one. I will use the above abbreviations to show you algorithms (repeated steps) to help you solve it.

### Steps:

1. Solve **White Plus**
  - Put the Upper edges in the correct place with the side centers.
  - I have no special sequence for this, it just comes from experience.
2. Put the **Upper corners** (white) in place.
  - Pay attention to side colors.
  - Don't worry about any layer except the White.
  - This should give you a short "T" on each side in the top two layers.
3. Move the **Middle Layer** edges in place.
  - Move one of the edge pieces on the bottom level until it make a large "T" on one side.
  - If the other color of the bottom of the "T" is yellow, find another edge to make a large "T".
  - The "T" color is now your Front side.
  - If the bottom of the "T" has the color of the Right side do this:
    - **d r D R D F d f**
  - if the bottom of the "T" has the color of the Left side do this:
    - **D L d l d f D F**

4. Repeat step 3 so that you have middle layer complete (the upper layer should also be done).
5. Flip the cube so the Upper is the Yellow side and solve for the **Yellow Plus**.
  - This sequence (F R U r u f) will cycle the edges between the following yellow face results:



- You may get a single yellow center only, just do the sequence again.
  - Just keep doing it until you get the yellow plus.
6. Move the **Upper Edges** into the correct place.
    - Move the Yellow-Red edge in place.
    - This sequence (R U r U R U<sup>2</sup> r) will exchange the other three edges
      - Do this until you get all the edges on the correct side.
    - If you get 2 edges in place and two out of place, flip the cube around so the Orange face is front, do the sequence once, then rotate the upper until the edges are correct.
  7. Move the **Upper Corners** into the correct place.
    - Find one corner that is in the correct place\*, it does not have to have the correct orientation.
      - Rotate the cube to place that corner in the Upper/Right corner
      - This sequence (U R u l U r u L) will rotate the other three corners.
      - Do this until the corners are all in the correct place regardless of their orientation.
    - \* if no corner is in the correct place, do the sequence once then find one corner that is in place.
  8. **Correct the Upper Corners.**
    - You will have anywhere from 1 to 4 corners that need correcting.
    - Start with one corner in the Upper/Right of the Front, keep the front the same throughout the moves, and complete this sequence (r d R D) as many times as you need to.
    - When the Yellow side of the Upper/Right corner is correct, keep the front the same and move the upper side counterclockwise until the next corner that needs to be corrected is in the Upper/Right then repeat the sequence.
    - It will seem like you are messing up, but it will correct itself eventually. Be sure to complete the four step sequence each time.
    - Once the last Yellow corner is done, move the layers until it is solved!

Source:

Rubik and the Cube - Rubik's Cube, [http://inventors.about.com/od/rstartinventions/a/Rubik\\_Cube.htm](http://inventors.about.com/od/rstartinventions/a/Rubik_Cube.htm)