Magic Cube

Luudoo
Customised Games

Basics and object of the game

The Magic Cube is a 3D puzzle base on the The Rubik's Cube, invented in 1974 by Hungarian sculptor and professor of architecture Ern Rubik. Classically, the cube's faces are white, red, blue, orange, green, and yellow. Each face consists of 9 smaller cubes, and the Rubik's cube's internal pivot mechanism enables each face to turn independently, thus mixing up the colours. For the puzzle to be solved, each face must be returned to have only one colour.

Besides merely solving the puzzle, there are many disciplines like speedcubing, with international competitions organised by the World Cube Association.

Luudoo's Magic Cubes and the problem of Supercubes

The original Rubik's Cube had no orientation markings on the centre faces (although some carried the words „Rubik's Cube" on the centre square of the white face), and therefore solving it does not require any attention to orienting those faces correctly. However, one could mark the central squares of an unscrambled Cube with four coloured marks on each edge, each corresponding to the colour of the adjacent face; a cube marked in this way is referred to as a „Supercube". Luudoo's Magic Cubes may have a picture on each face, and centre orientation may matter on these as well. Thus one can nominally solve a Cube yet have the markings on the centres rotated; it then becomes an even harder challenge to solve the centres and pictures as well!

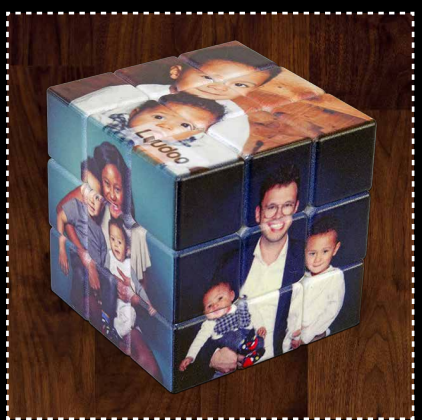
Solving the Cube

Solutions can be described as a sequence of algorithms. Algorithms, in turn, are a sequence of moves.

Moves

Many 3×3×3 Cube enthusiasts use a notation developed by David Singmaster to denote a sequence of moves, referred to as „Singmaster notation". Its relative nature allows algorithms to be written in such a way that they can be applied regardless of which side is designated the top or how the colours are organised on a particular cube.

- F (Front): the side currently facing the solver
- B (Back): the side opposite the front
- U (Up): the side above or on top of the front side



- D (Down): the side opposite the top, underneath the Cube
- L (Left): the side directly to the left of the front
- R (Right): the side directly to the right of the front
- f (Front two layers): the side facing the solver and the corresponding middle layer
- b (Back two layers): the side opposite the front and the corresponding middle layer
- u (Up two layers): the top side and the corresponding middle layer
- d (Down two layers): the bottom layer and the corresponding middle layer
- l (Left two layers): the side to the left of the front and the corresponding middle layer
- r (Right two layers): the side to the right of the front and the corresponding middle layer
- x (rotate): rotate the entire Cube on R
- y (rotate): rotate the entire Cube on U
- z (rotate): rotate the entire Cube on F

When a prime symbol ( ) follows a letter, it denotes an anticlockwise face turn; while a letter without a prime symbol denotes a clockwise turn. These directions are as one is looking at the specified face. A letter followed by a 2 (occasionally a superscript 2) denotes two turns, or a 180-degree turn. R is right side clockwise, but R is right side anticlockwise. The letters x, y, and z are used to indicate that the entire Cube should be turned about one of its axes, corresponding to R, U, and F turns respectively. When x, y, or z are primed, it is an indication that the cube must be rotated in the opposite direction. When they are squared, the cube must be rotated 180 degrees.

The most common deviation from Singmaster notation, and in fact the current official standard, is to use „w“, for „wide“, instead of lowercase letters to represent moves of two layers; thus, a move of Rw is equivalent to one of r.

Algorithms

A Rubik's Cube algorithm is a memorised sequence of moves that has a desired effect on the cube. Each method of solving the Cube employs its own set of algorithms, together with descriptions of what effect the algorithm has, and when it can be used to bring the cube closer to being solved.

Many algorithms are designed to transform only a small part of the cube without interfering with other parts that have already been solved so that they can be applied repeatedly to different parts of the cube until the whole is solved. For example, there are well-known algorithms for cycling three corners without changing the rest of the puzzle or flipping the orientation of a pair of edges while leaving the others intact.

Some algorithms do have a certain desired effect on the cube (for example, swapping two corners) but may also have the side-effect of changing other parts of the cube (such as permuting some edges). Such algorithms are often simpler than the ones without side-effects and are employed early on in the solution when most of the puzzle has not yet been solved and the side-effects are not important. Towards the end of the solution, the more specific (and usually more complicated) algorithms are used instead.

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Cheat code

The most move-optimal online Rubik's Cube solver programs uses Herbert Kociemba's Two-Phase Algorithm which can typically determine a solution of 20 moves or fewer. The user has to set the colour configuration of the scrambled cube, and the program returns the steps required to solve it. In fact, the minimum number of moves in which any configuration of the cube can be solved is 20, as was shown in 2010.