

## Abstract

The Rubik's Cube, an iconic 3D puzzle, has captured the imagination of enthusiasts and mathematicians alike for decades. This poster delves into the mathematical intricacies of the Rubik's Cube. We investigate the cube's symmetry, its staggering number of possible permutations, and the use of computer aided proof-assistants to calculate the algorithms to solve the Rubik's Cube. Whether you're a puzzle enthusiast or a math fanatic, this poster invites you to embark on a fascinating journey into the world of Rubik's Cube mathematics.

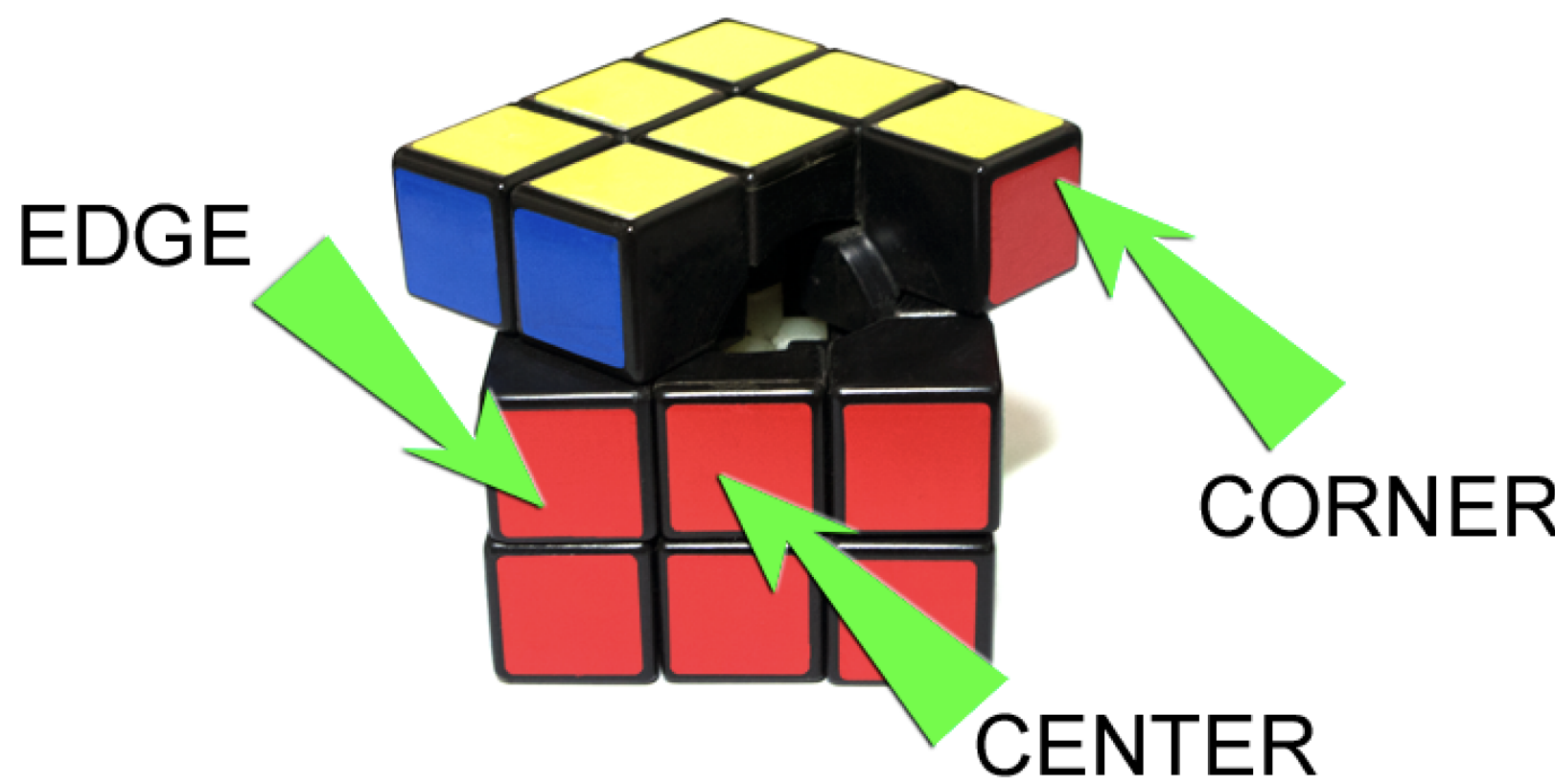
## Combinations of a Rubik's Cube

There are three (four if you count the not-visible core) types of pieces:

- **Corners:** 8 of these on each corner of the cube
- **Edges:** 12 of these connecting adjacent corners
- **Centers:** 6 of these on each face of the cube

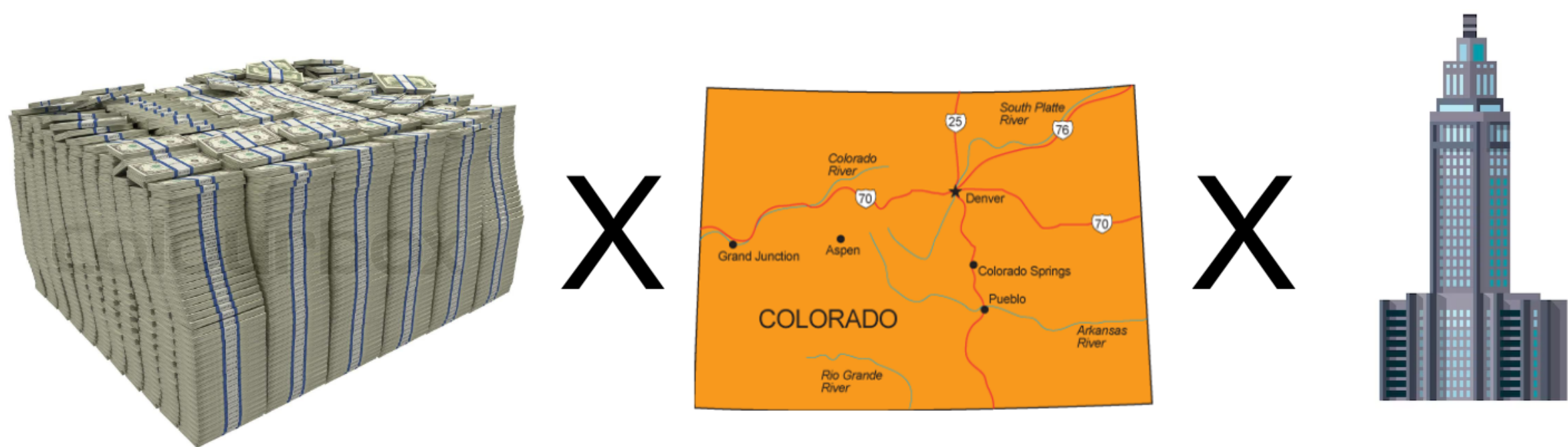
There are  $8!$  ways we can permute the corner pieces to the corners of a cube, and  $12!$  ways we can permute the edge pieces into the 12 edge slots of a cube. There are  $3^8$  ways we can orient the corner pieces and  $2^{12}$  ways we can the edge pieces. We also have to divide by 12, since some states are impossible. This yields the final formula:

$$\frac{8! \cdot 12! \cdot 3^8 \cdot 2^{12}}{12} = 43252003274489856000$$



## How big is 43 Quintillion?

Imagine we had a dollar for each rubik's cube combination there was. If were to lay one layer of one dollar bills in Colorado, it would take 25 trillion dollars. We would have to stack that another 2 million times to use all of our money. The stack would be about the same height of the tallest building in Denver. In other words, the money would cover all of Colorado in a layer as tall as a skyscraper.



## Solving a Rubik's Cube

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## God's Algorithm and Number

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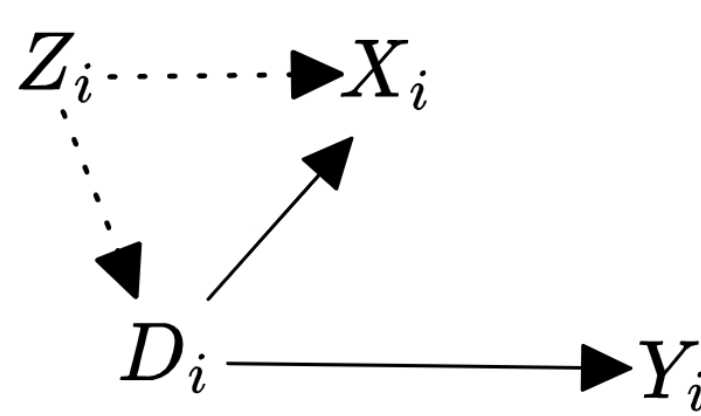


Figure 1. Another figure caption.

## Proof Assistants/Computer Aided proof

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## Statistics of Speed Cubing

$$\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$$

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## What about larger Rubik's Cubes?

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First column	Second column	Third column	Fourth
Foo	13.37	384,394	$\alpha$
Bar	2.17	1,392	$\beta$
Baz	3.14	83,742	$\delta$
Qux	7.59	974	$\gamma$

Table 1. A table caption.

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## References