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National Museum of American History



FYS 1245

The Nature of Math in Puzzles and Games

- No prerequisites
- Games and Puzzles build community
- Highlight math different from typical high school
- Topics include graph theory, number theory, topology, and logic.

Chapter 6

Games and Puzzles



Thus far, the problems we have encountered have been serious problems, for the most part, and several have potentially important implications. However, part of the entertaining aspect of graph theory lies in its usefulness for analyzing certain kinds of games and puzzles. In this chapter we look into a few of the less serious applications of graphs.

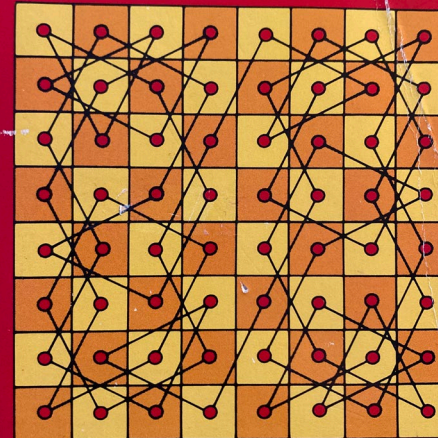
6.1

The Problem of the Four Multicolored Cubes: A Solution to “Instant Insanity”

The “Instant Insanity” Problem

THE PUZZLE “INSTANT INSANITY” (which is a trade name used by the Parker Brothers Game Company) consists of four cubes, and each cube’s six faces are colored from four given colors:

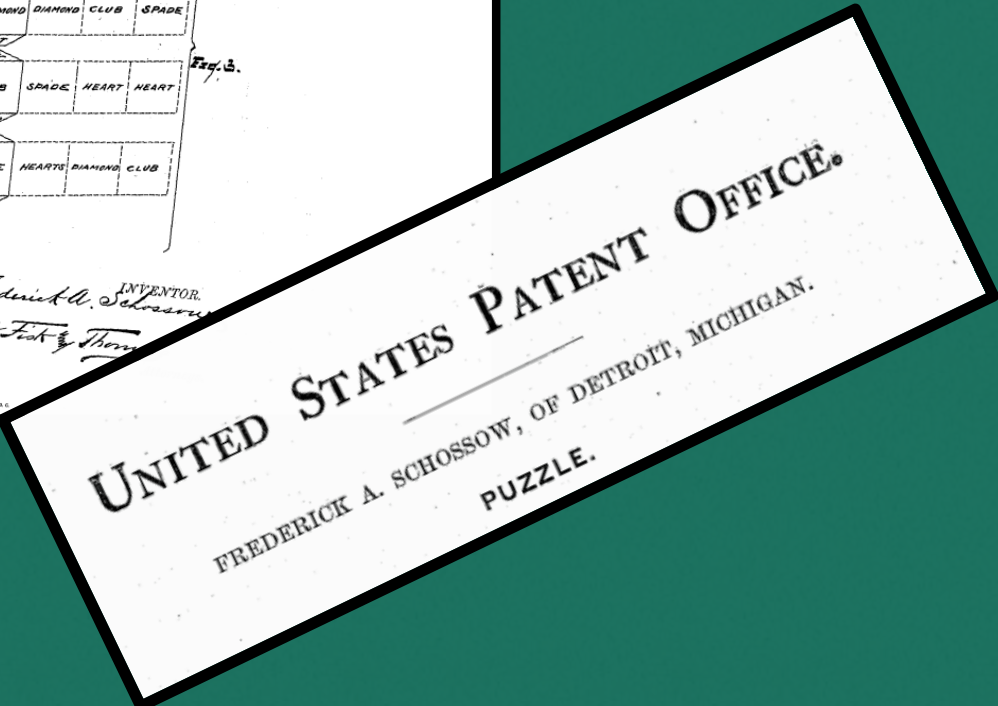
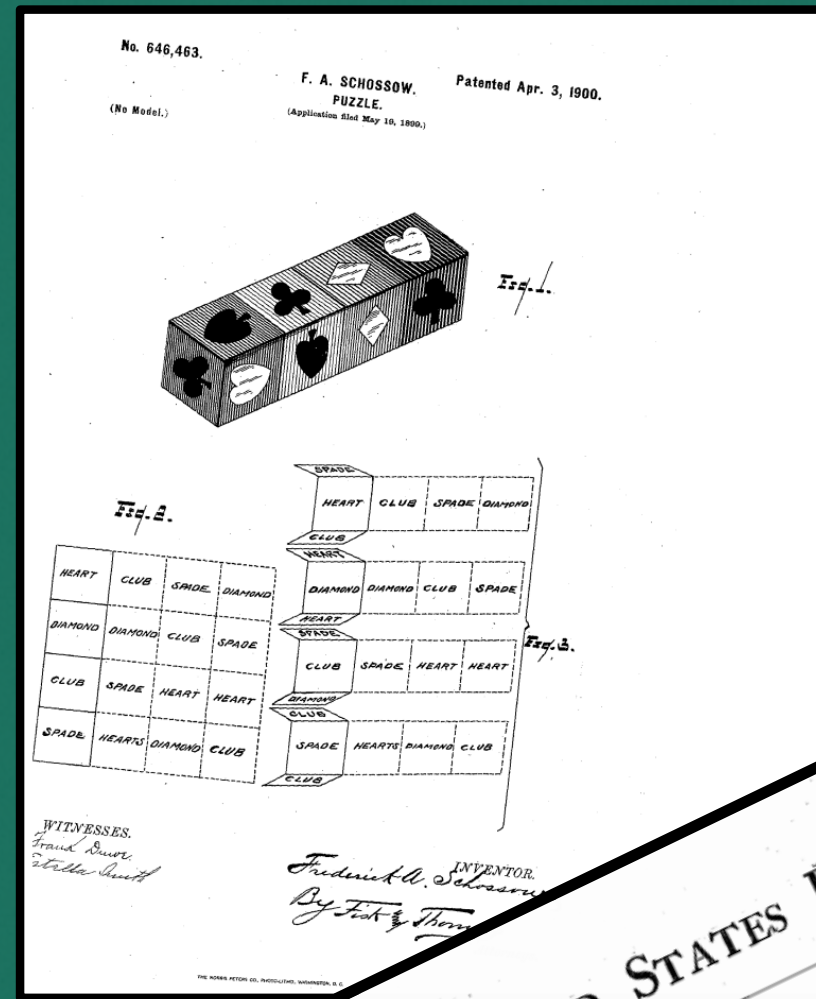
Introductory Graph Theory

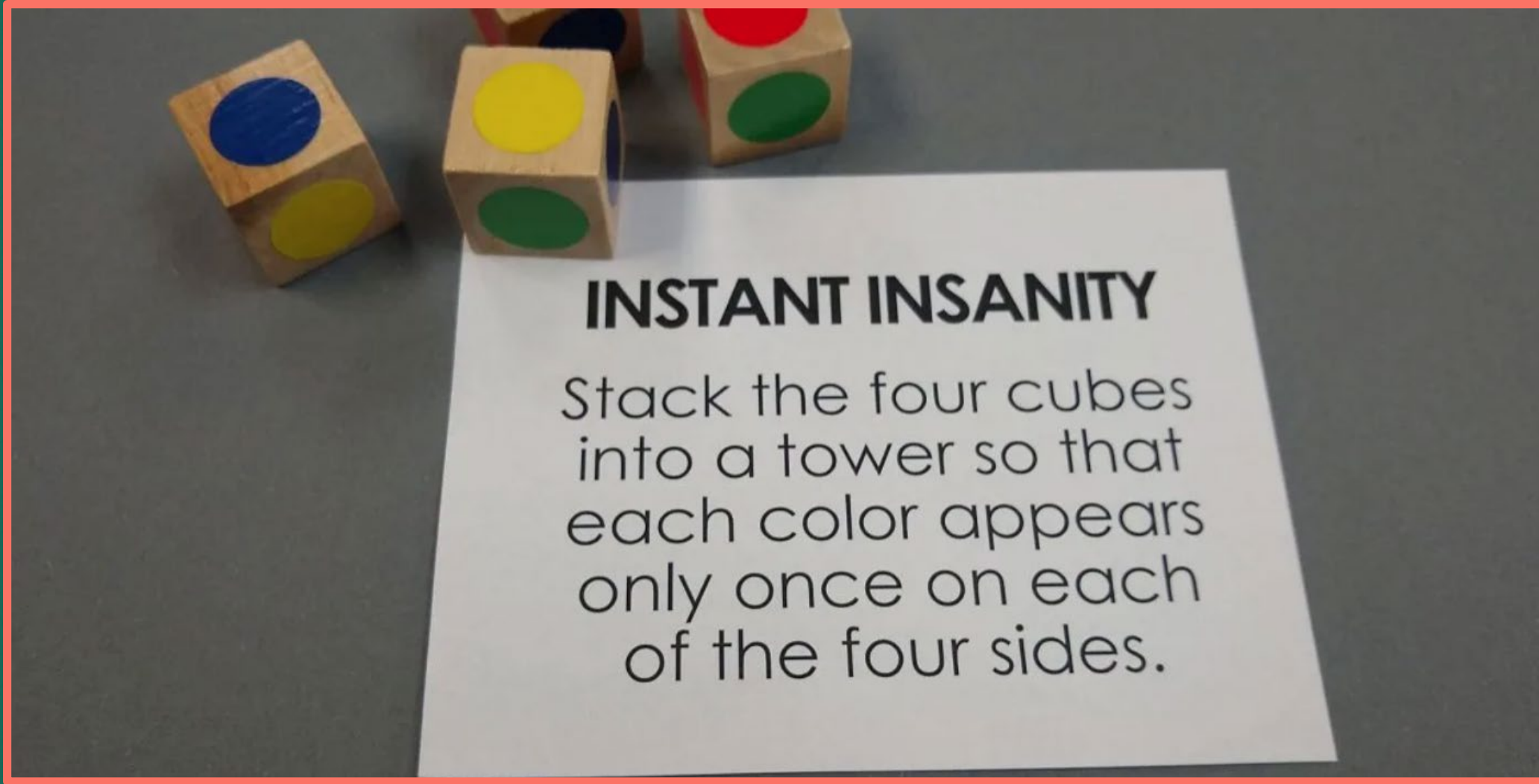


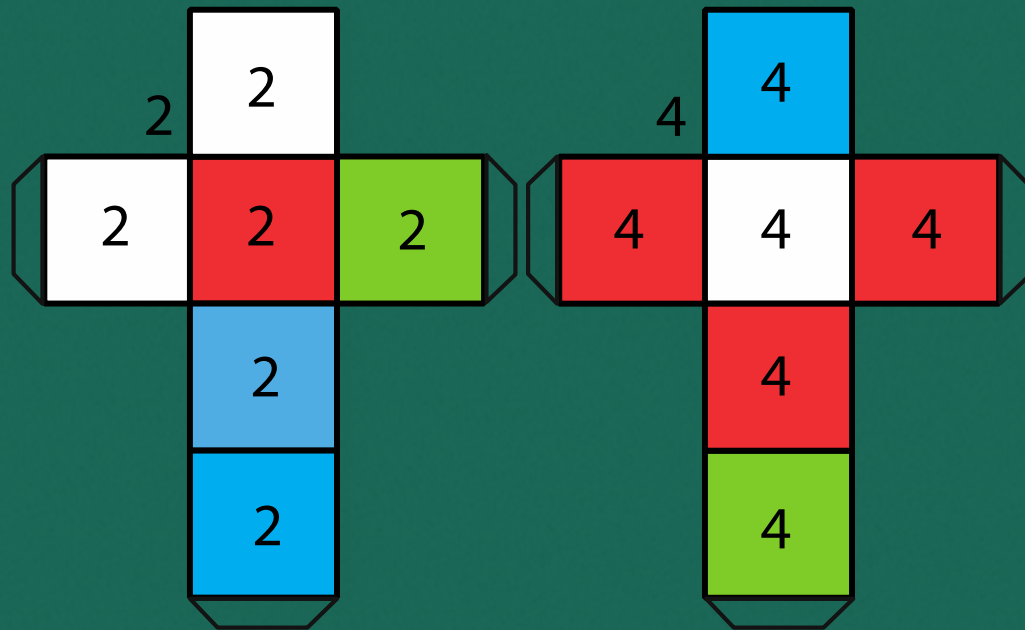
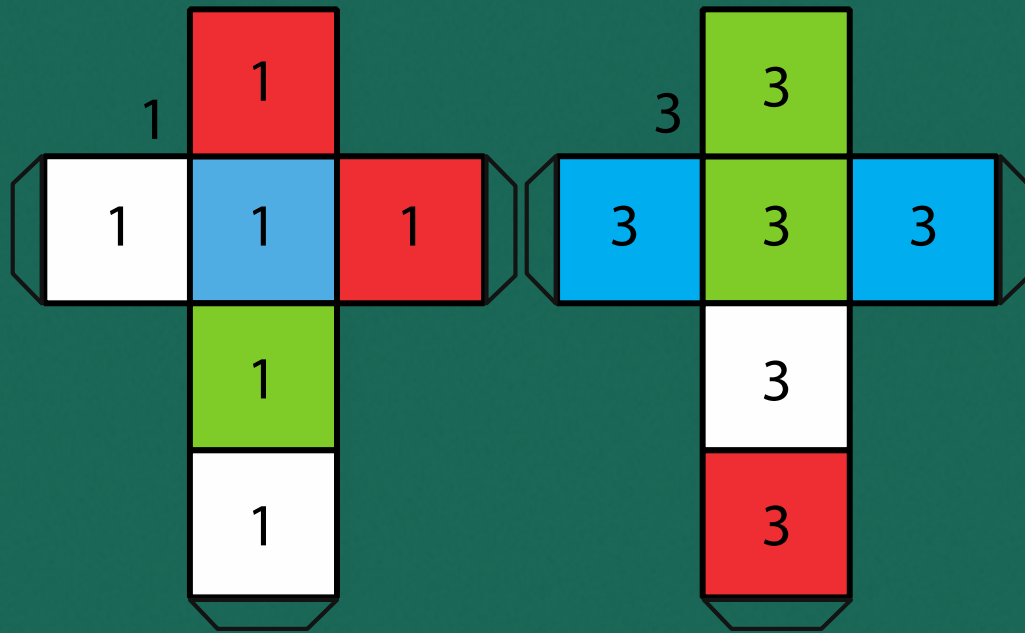
Gary Chartrand

*Katzenjammer
 (Great) Tantalizer
 Face-4
 Cube-4,
 Bognar Balls
 Taktikolor
 Frantic Diabolical Damblocks
 Symington's Puzzle*

Patented by F. Schossow in 1900.







Printable pdf
students use to
assemble their
own set of cubes

<https://www.thinkfun.com/wp-content/uploads/2013/08/instantsanity-instructions.pdf>

Survivor Challenge



41,472 possible towers: Why?

How many ways can we sit the first cube down?

$$6 \text{ faces} \times 4 \text{ orientations} = 24$$

Repeated for all 4 cubes.

$$24 \times 24 \times 24 \times 24 = 331,776$$

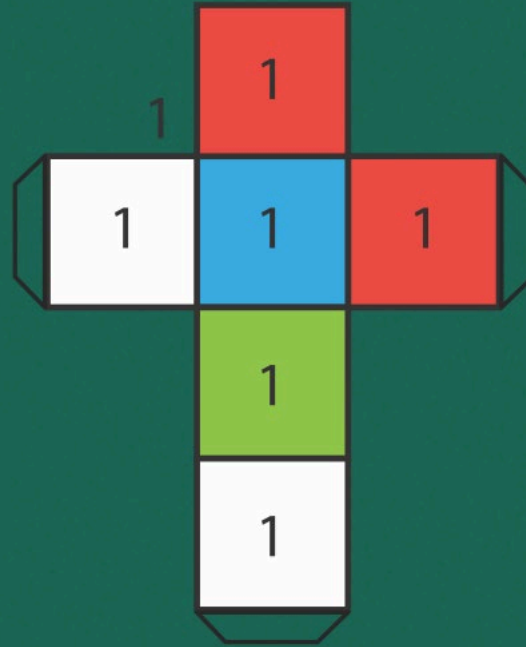
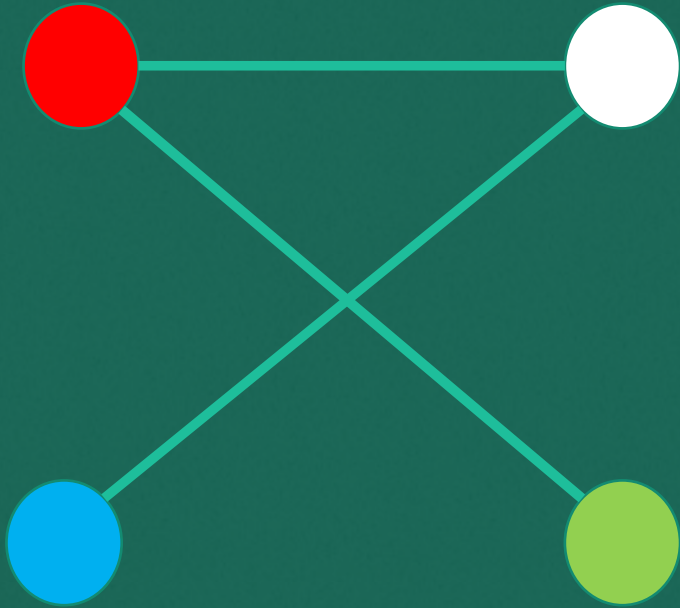
Because of symmetry of the solutions, we are overcounting.

Rotating tower = 4 Flipping the tower = 2

$$331,776 / 8 = 41,472$$



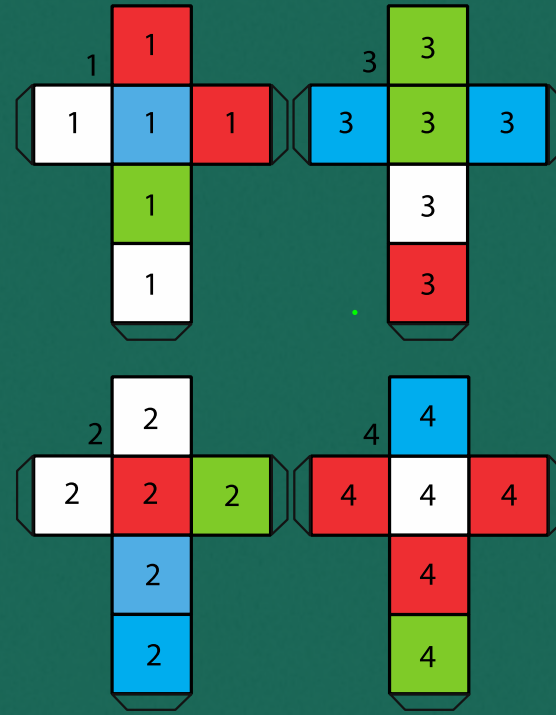
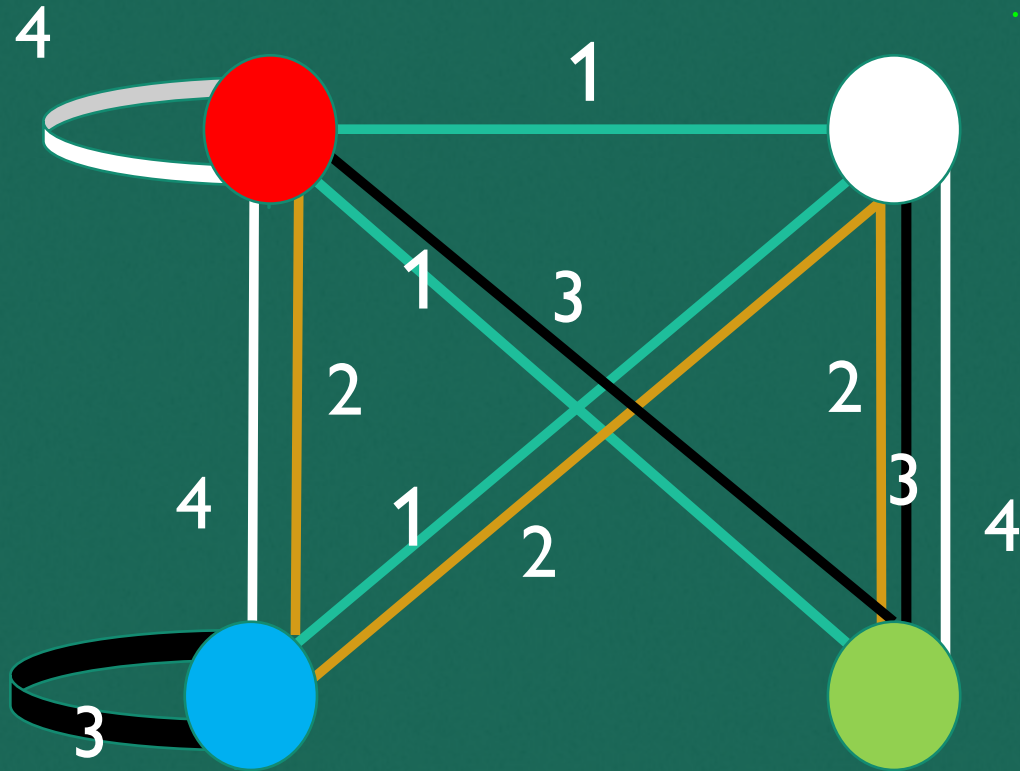
Graph Theory provides a visual display of the relationships within the cube.



Vertex = color

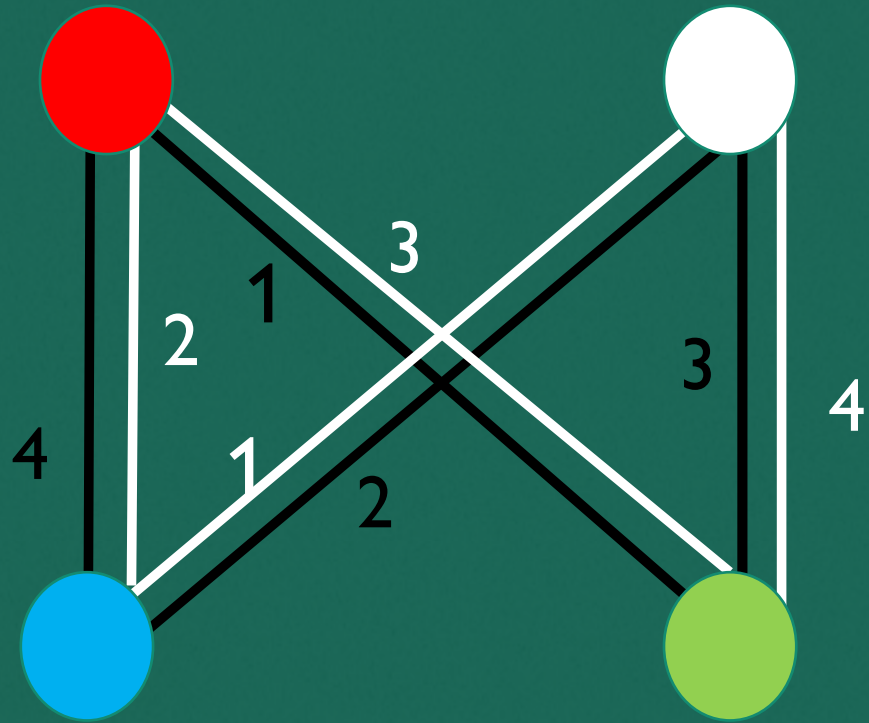
Edge = colors that appear on opposite faces

Combine all 4 graphs into one to represent the puzzle:



What is required to find a solution to the puzzle?

Path of length 4 that passes through each vertex exactly once and includes edges labelled 1, 2, 3, 4



R - 1 - G - 3 - W - 2 - B - 4 - R

W - 1 - B - 2 - R - 3 - G - 4 - W

F - B

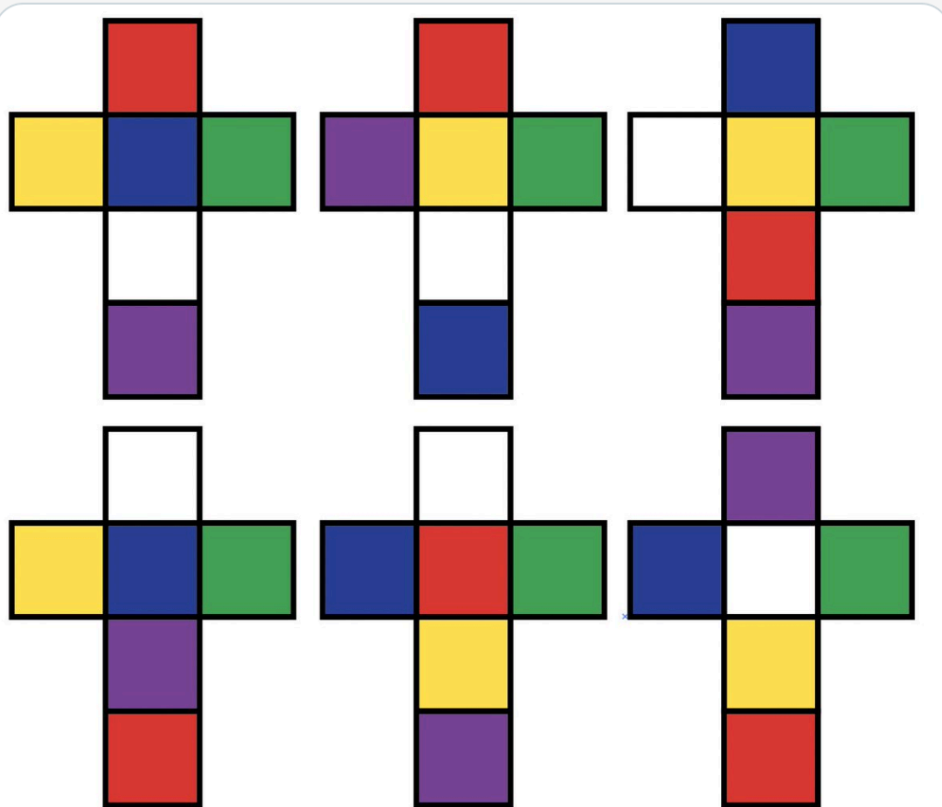
L - R

Twitter Inspiration



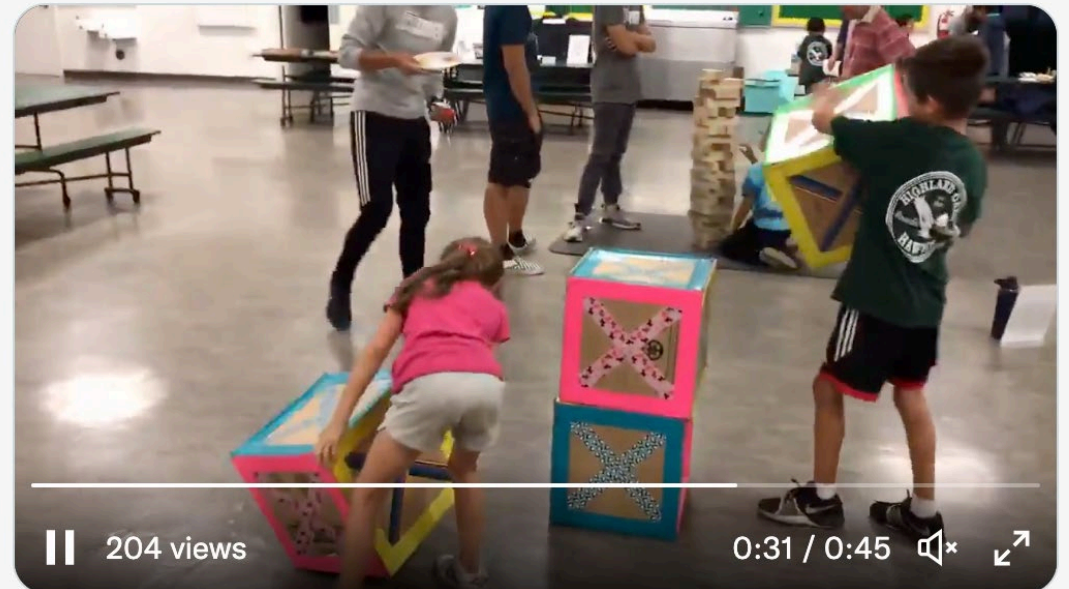
Dave Richeson @divbyzero · Nov 29, 2022

OK. Here's one more Instant Insanity variant. It was created by T.A. Brown in 1968. Same rules except you are stacking six cubes with six colors. Because every cube displays every color and there is a solution, there are three solutions. (Justify!)



Bradley Smith @gauchobrad · Nov 2, 2018

Here at the 4th annual Game Night @AUSDHighlandOak Love watching my 2 angels work together on the **Instant Insanity** puzzle @K49smith



Thank you for listening!

