

Oceania MathsJam Gathering 2022

Combinatorics in Rubik's Cube

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OPEN MIC

- Introduction

MY FAVOURITE MOVIE



WHAT'S THE MEANING OF LIFE?

42

MY FAVOURITE NUMBER

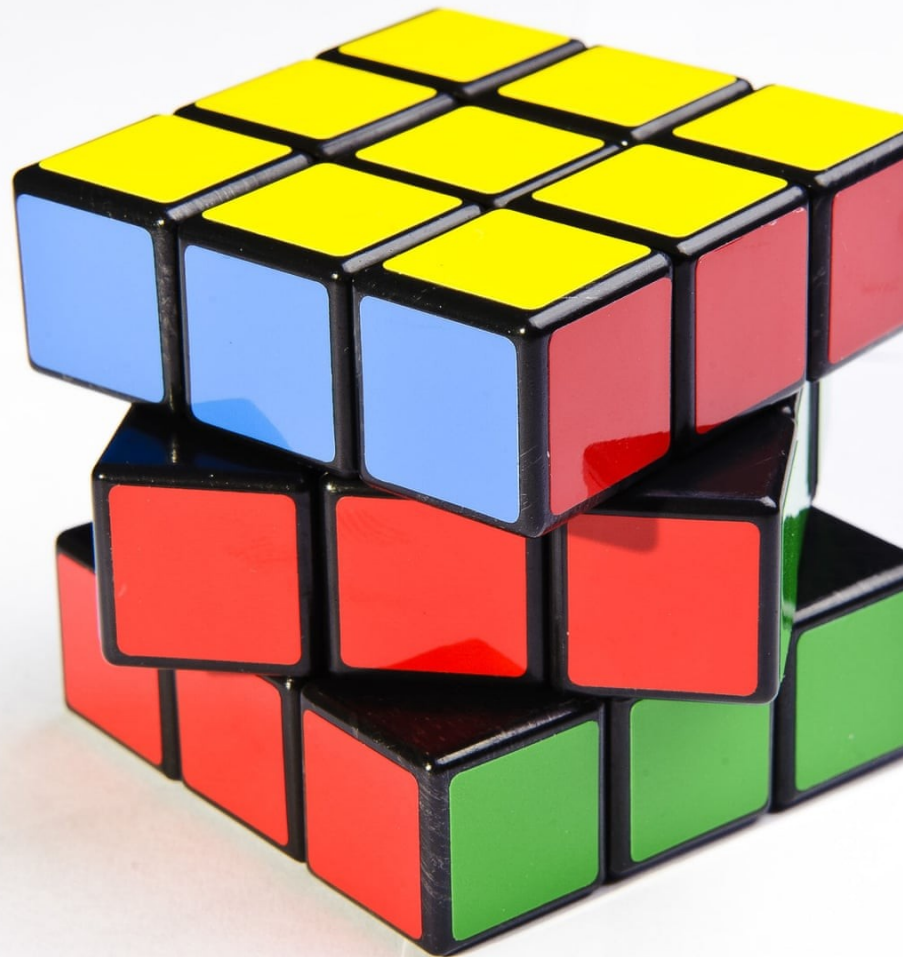
43

COMBINATIONS

43

Quintillion ($\times 10^{30}$)

RUBIK'S CUBE

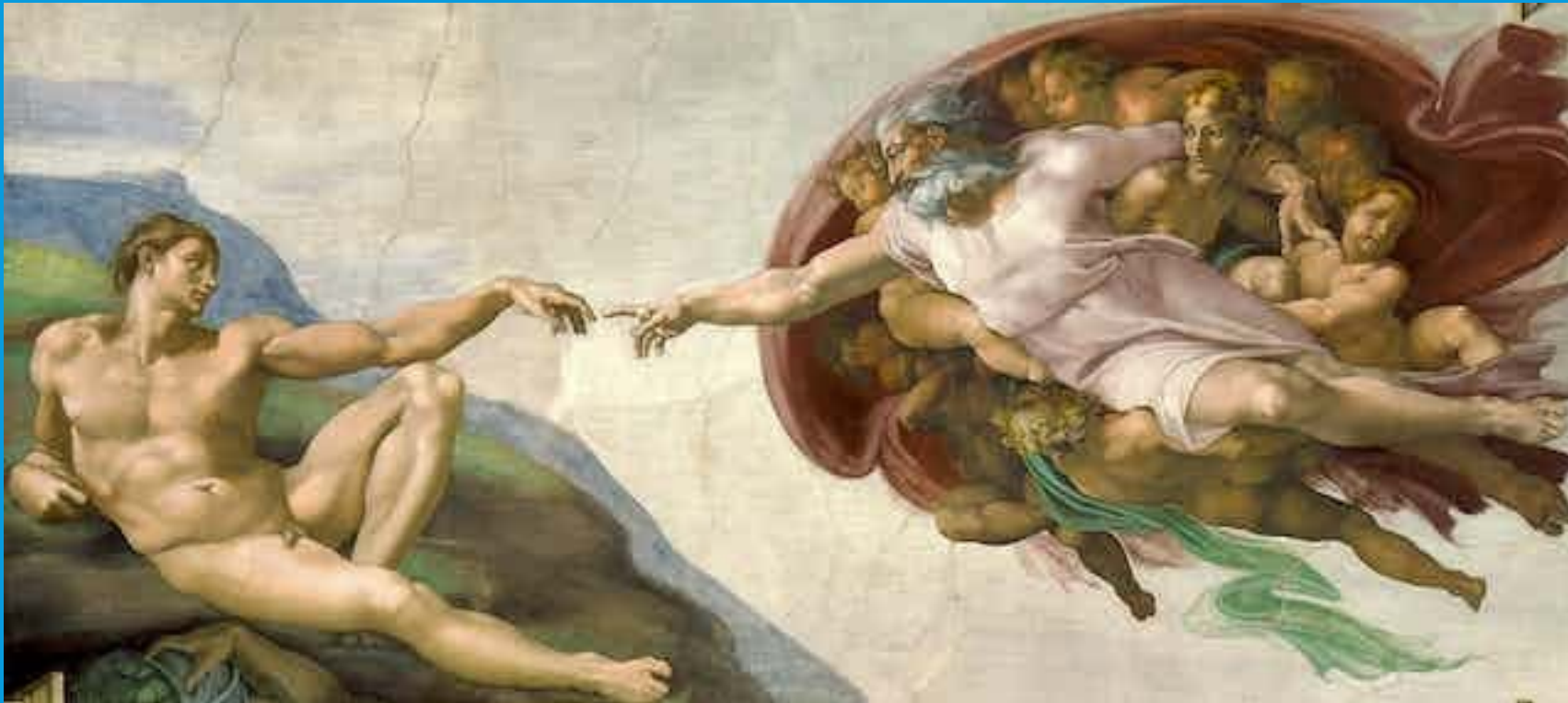


TOTAL COMBINATIONS

$$\frac{12!}{8!} \times \frac{1}{2^{11}} \times 3^7 \times \frac{1}{2} = 43 \times 10^{30}$$

WHAT'S THE **M**AXIMUM **N**UMBER OF
MOVES A **R**UBIK'S **C**UBE **C**AN BE
SOLVED?

WHAT'S GOD'S NUMBER?



OPEN AI - PLAYGROUND

The screenshot displays the OpenAI Playground interface. At the top left, the word "Playground" is shown. To its right is a dropdown menu labeled "Load a preset..." with a downward arrow. Further right are buttons for "Save", "View code", "Share", and a three-dot menu. The main area contains a text input field with the question "What's God's number?". Below it, the AI's response is displayed and highlighted in green: "There is no one answer to this question as people have different beliefs. Some believe that there is no specific number associated with God, while others may believe that it is 7, 12, or even 144." To the right of the input field is a microphone icon. On the right side of the interface, there are several settings: "Mode" with three icons (list, download, list); "Model" set to "text-davinci-002" with a dropdown arrow; "Temperature" set to 0.7 with a slider; "Maximum length" set to 256 with a slider; and "Stop sequences" with the instruction "Enter sequence and press Tab" and an empty input field. At the bottom left, there is a green "Submit" button followed by icons for undo, redo, refresh, and thumbs up/down. At the bottom right, there is a circular button with the number "7".

Date	Lower bound	Upper bound	Gap	Notes and Links
July, 1981	18	52	34	Morwen Thistlethwaite proves 52 moves suffice.
December, 1990	18	42	24	Hans Kloosterman improves this to 42 moves .
May, 1992	18	39	21	Michael Reid shows 39 moves is always sufficient.
May, 1992	18	37	19	Dik Winter lowers this to 37 moves just one day later!
January, 1995	18	29	11	Michael Reid cuts the upper bound to 29 moves by analyzing Kociemba's two-phase algorithm .
January, 1995	20	29	9	Michael Reid proves that the "superflip" position (corners correct, edges placed but flipped) requires 20 moves .
December, 2005	20	28	8	Silviu Radu shows that 28 moves is always enough.
April, 2006	20	27	7	Silviu Radu improves his bound to 27 moves .
May, 2007	20	26	6	Dan Kunkle and Gene Cooperman prove 26 moves suffice.
March, 2008	20	25	5	Tomas Rokicki cuts the upper bound to 25 moves .
April, 2008	20	23	3	Tomas Rokicki and John Welborn reduce it to only 23 moves .
August, 2008	20	22	2	Tomas Rokicki and John Welborn continue down to 22 moves .
July, 2010	20	20	0	Tomas Rokicki, Herbert Kociemba, Morley Davidson, and John Dethridge prove that God's Number for the Cube is exactly 20.

WHAT'S THE MEANING OF LIFE?

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