Understanding Mathematics through Puzzles

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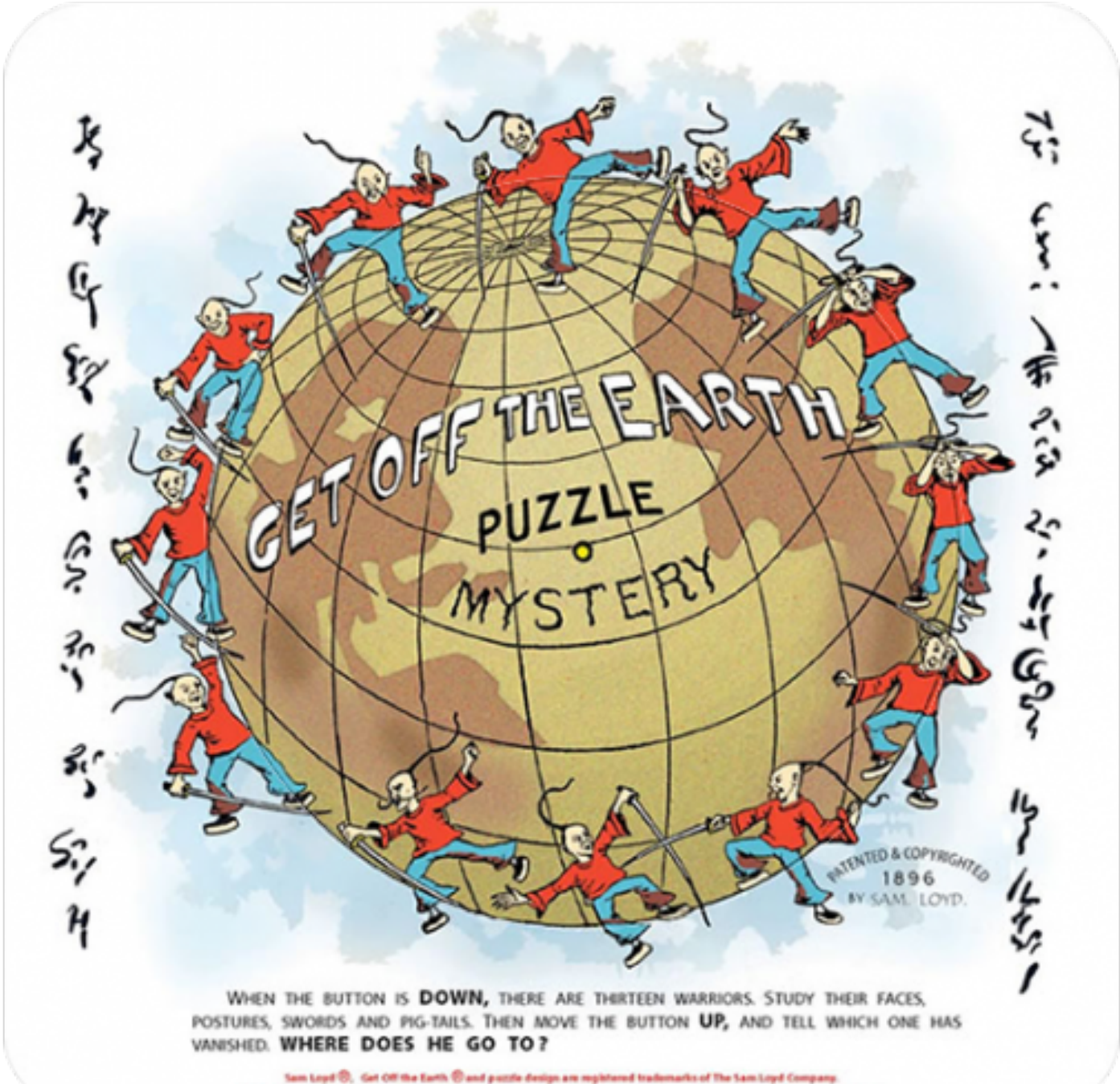
0+2=2

Get off the earth!



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Get off the earth!

0+2=2

Get off the earth!

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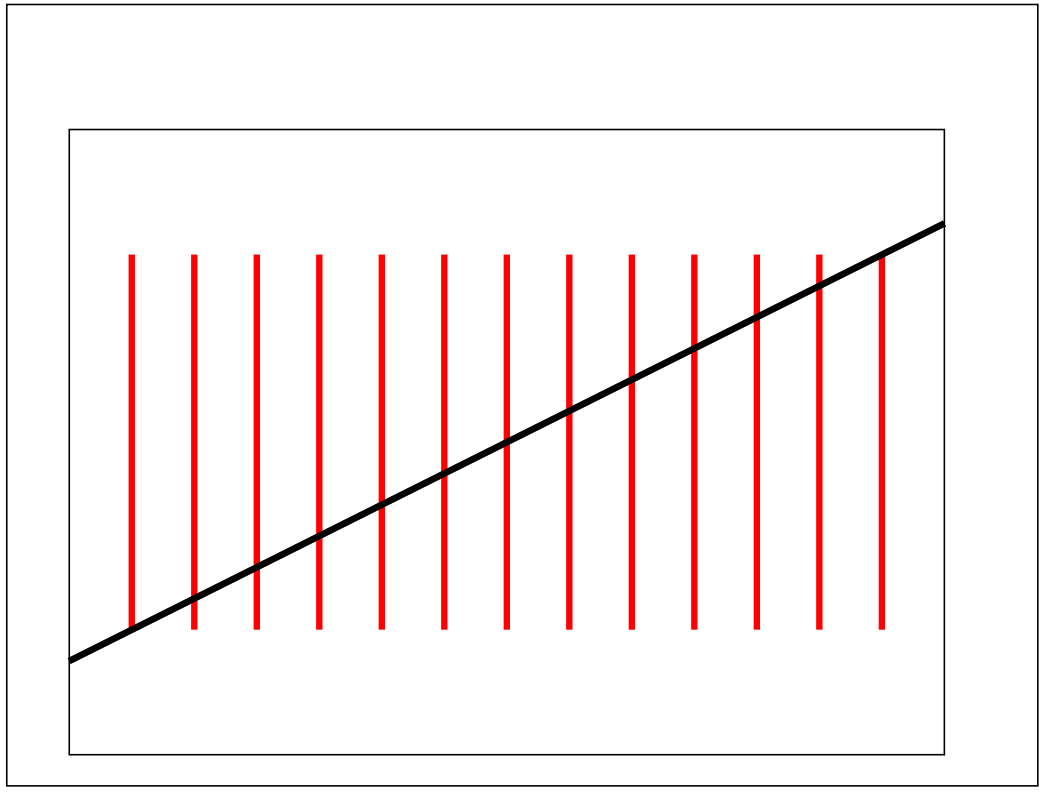
Get off the earth!

2+2=4

Mathematical perspective



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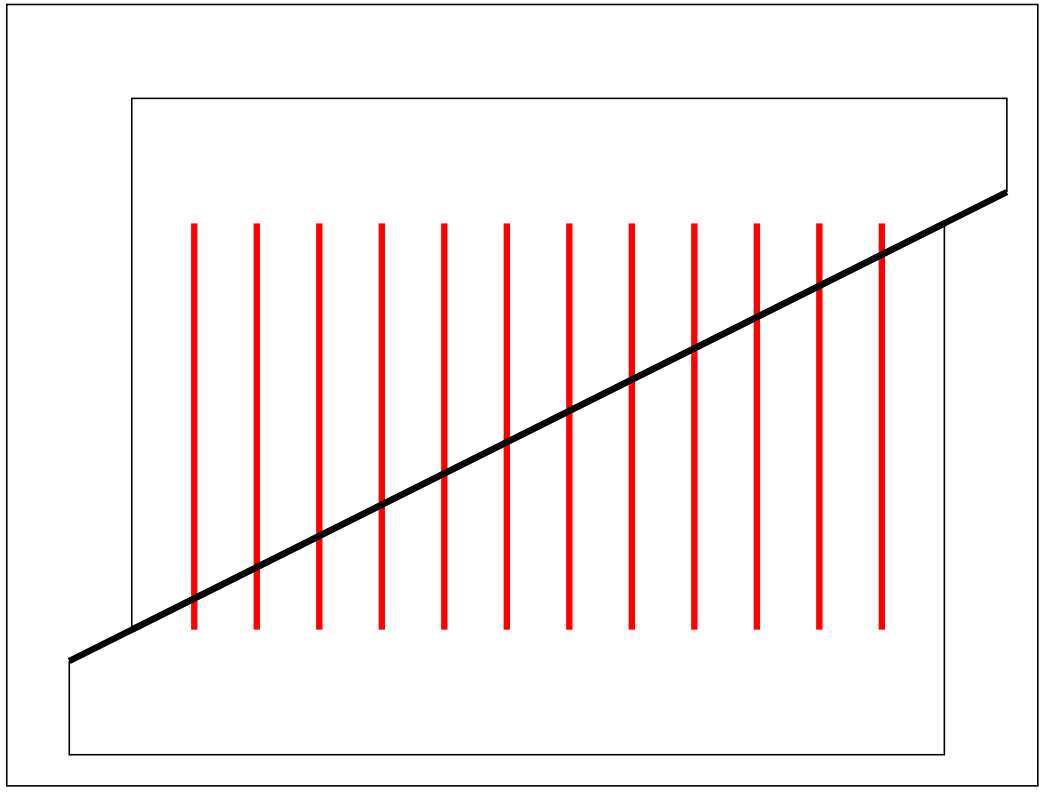

4+2=6

Making your own

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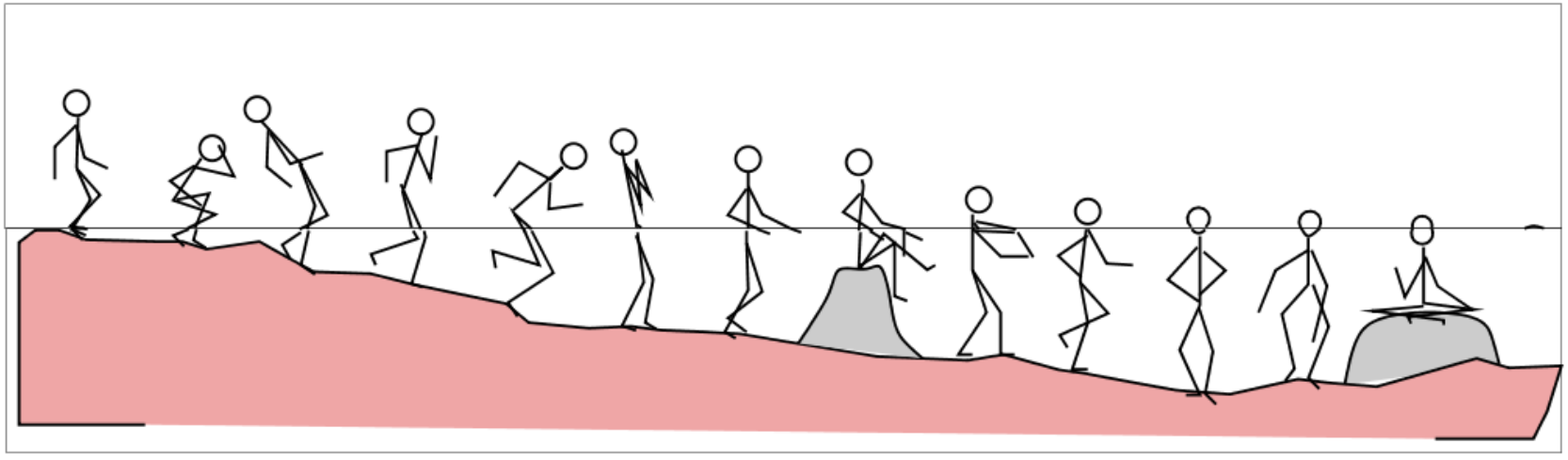

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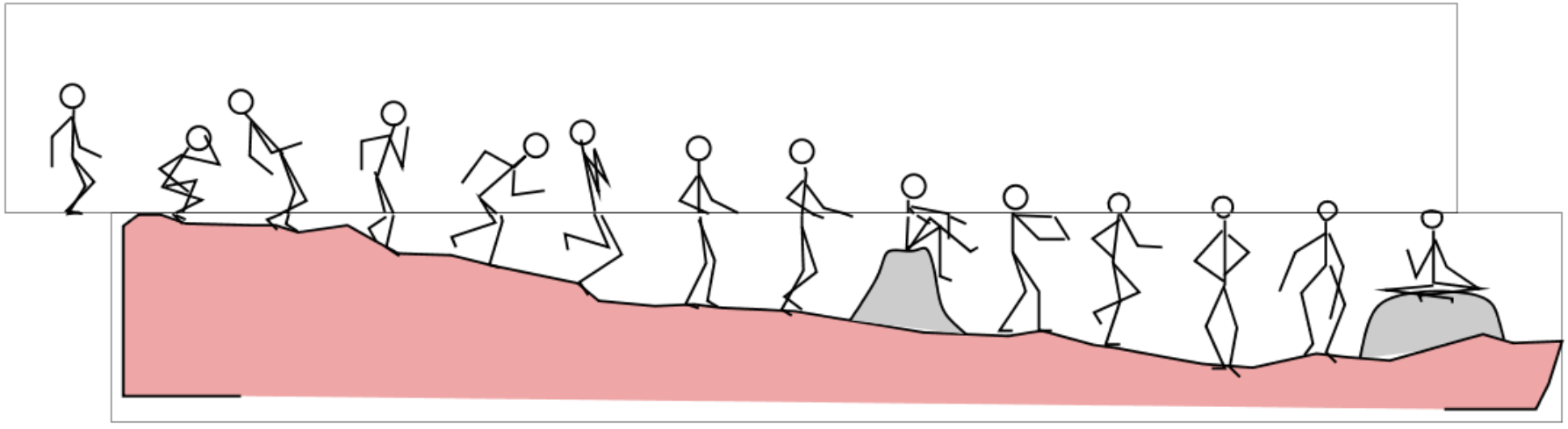


6+2=8

Invariance

Puzzle of the five cups

Puzzle of the five cups

Puzzle of the symbols

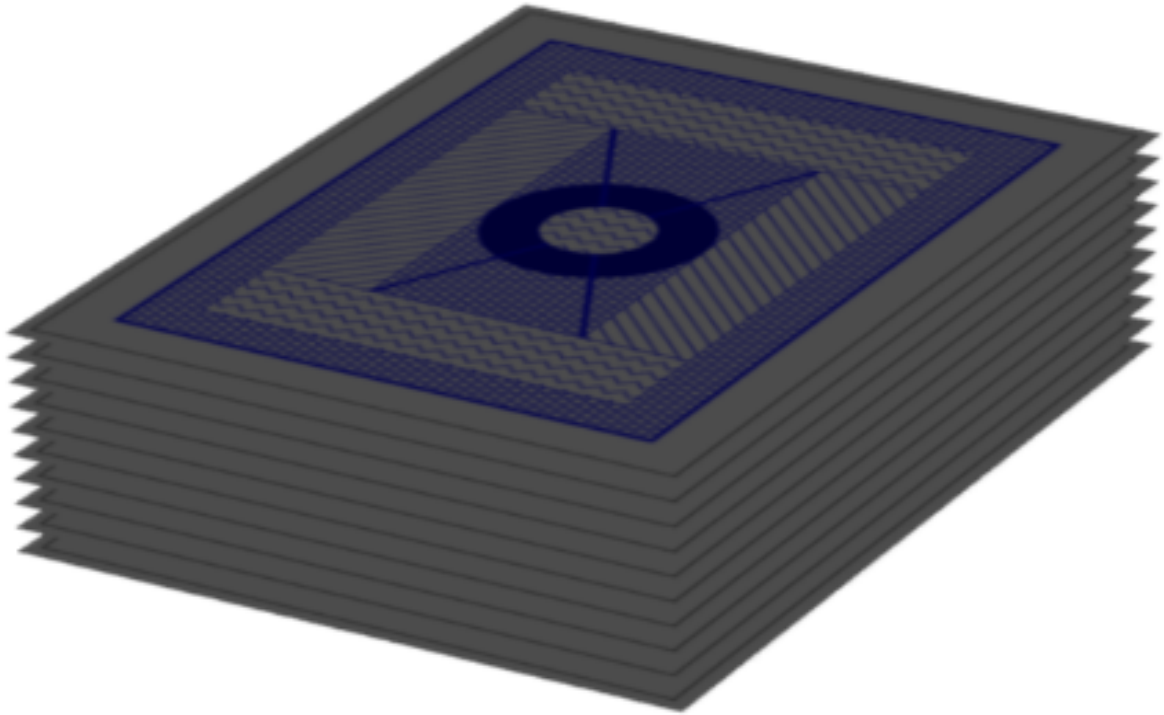
Puzzle of the five cups

Puzzle of the symbols

Magic of Bob Hummer

8+2=10

Cut



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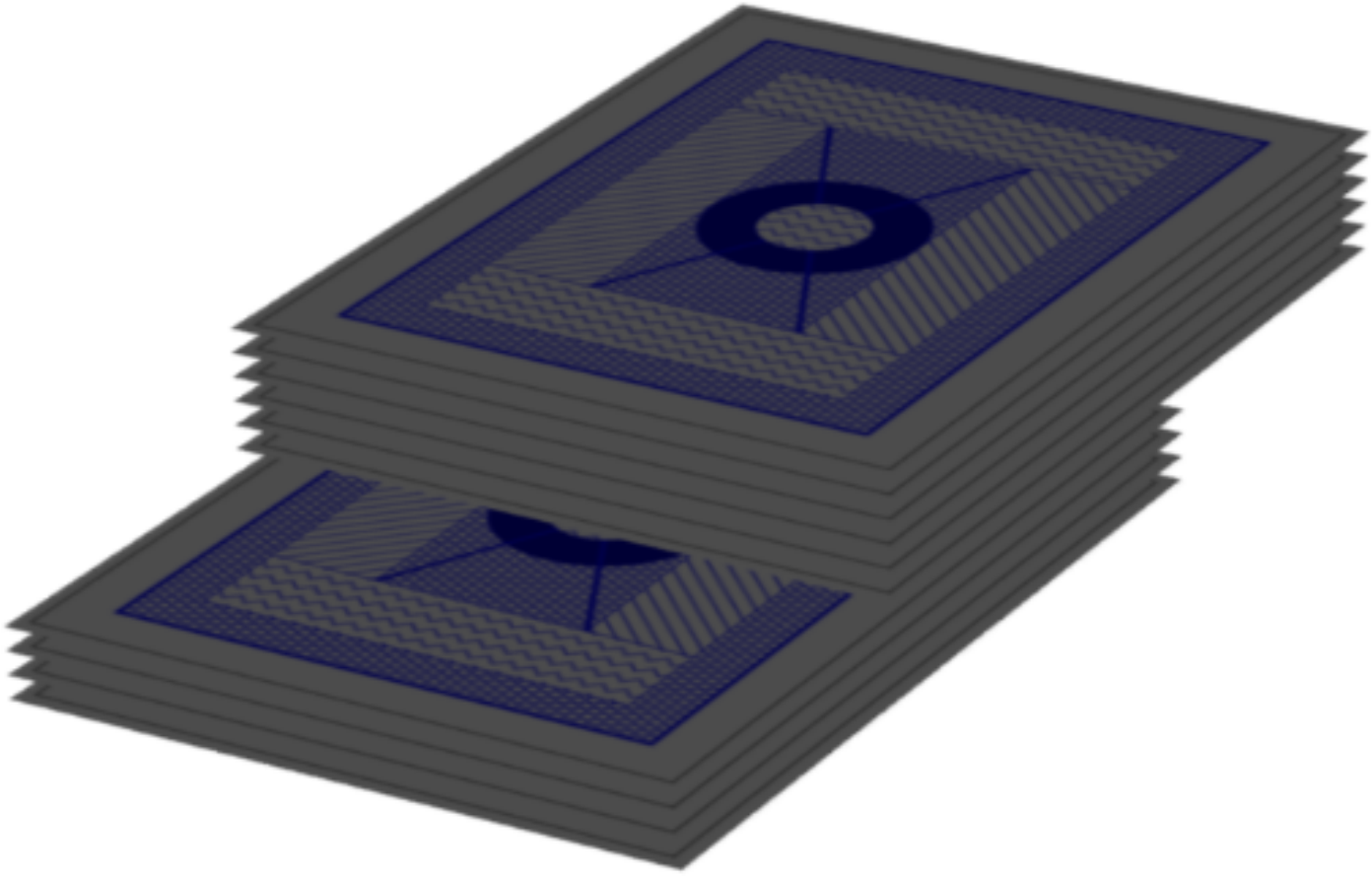

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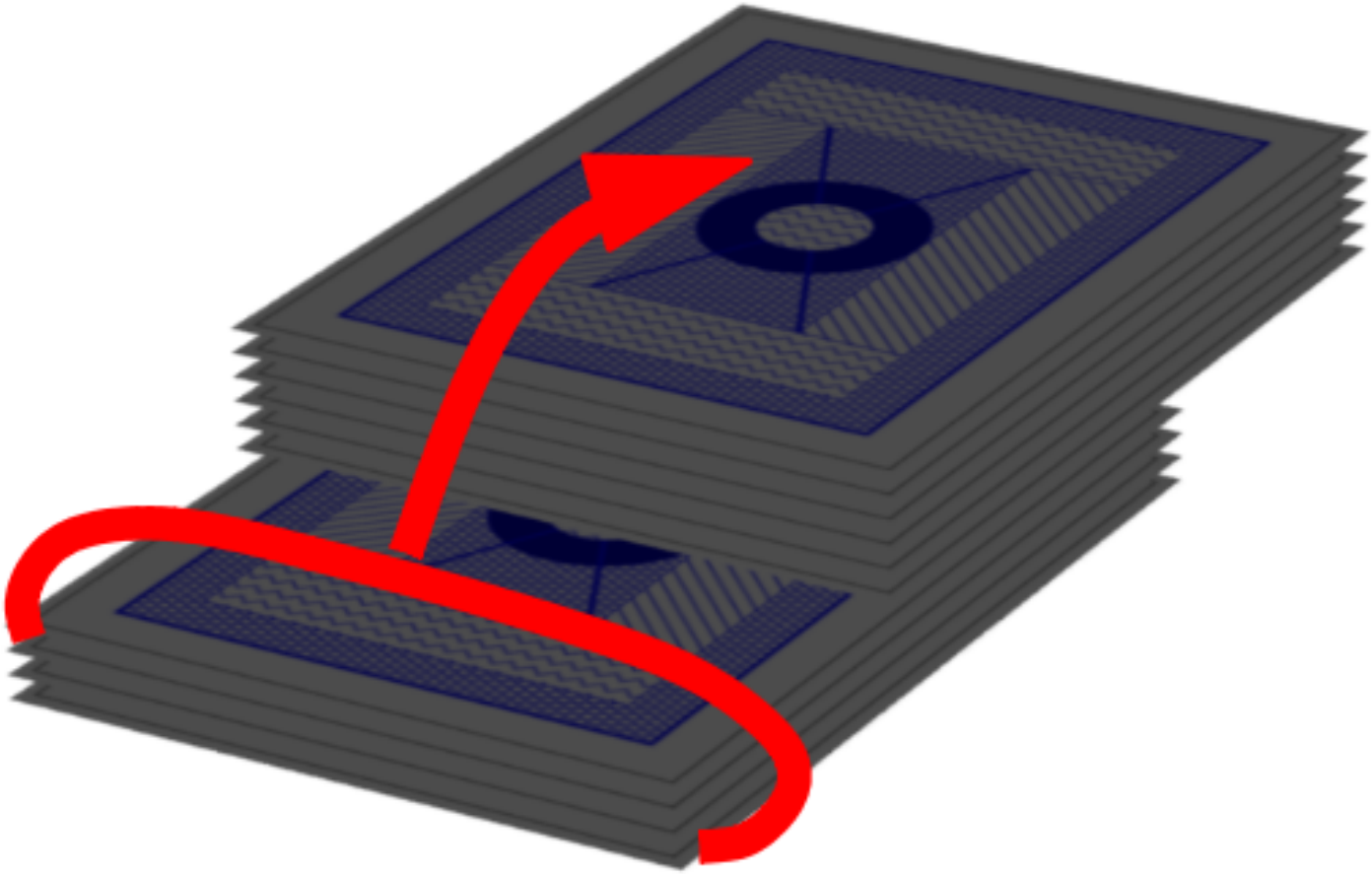
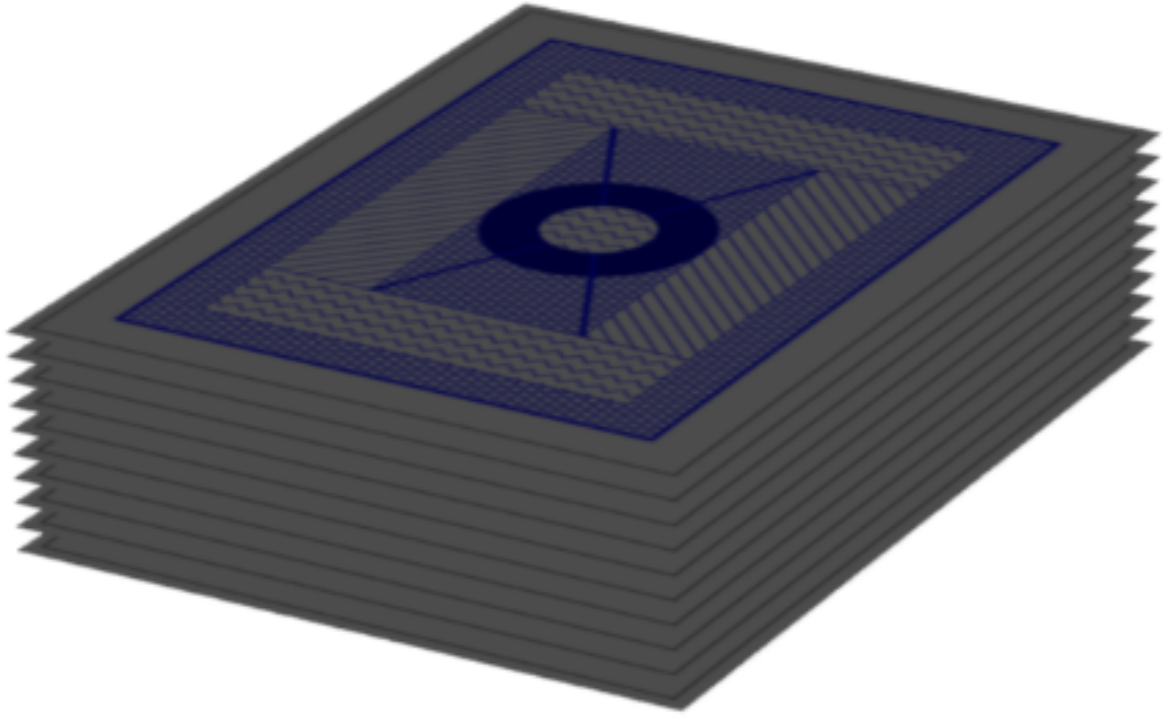


10+2=12

Flip top two together



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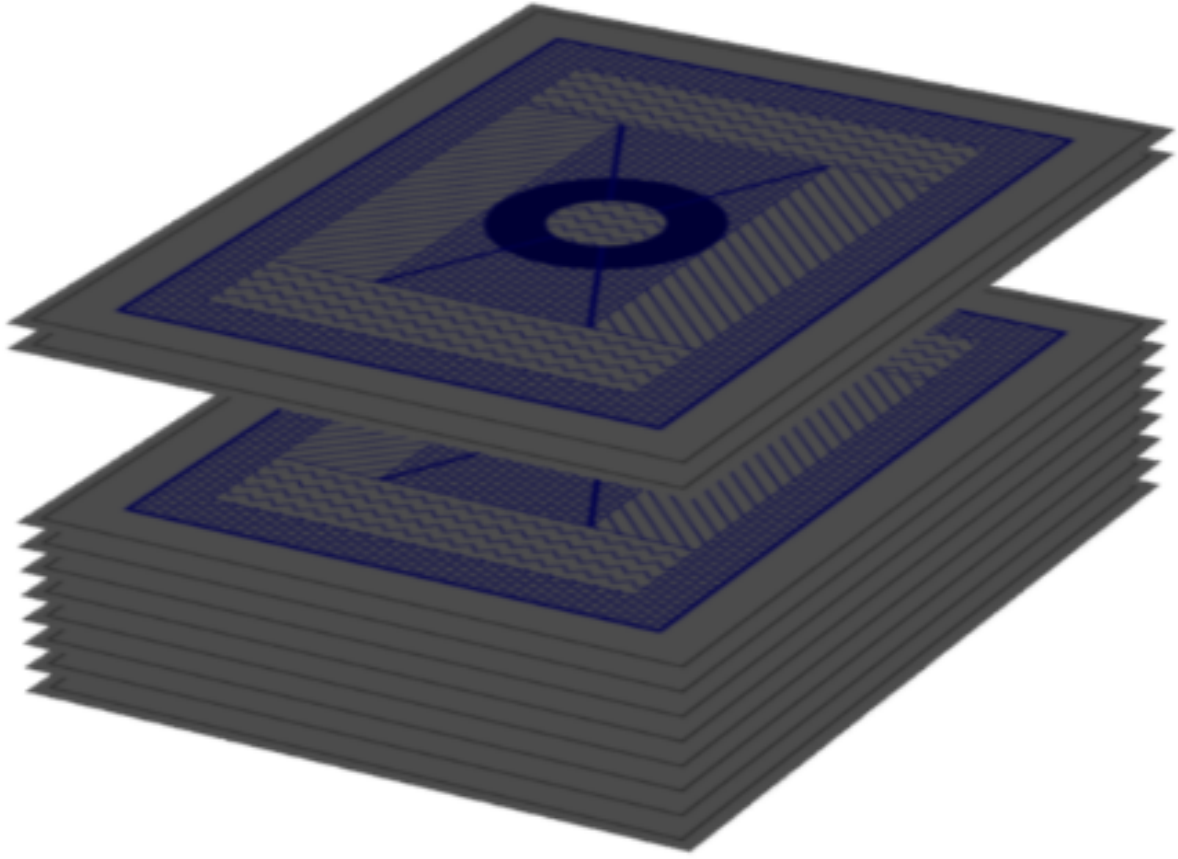

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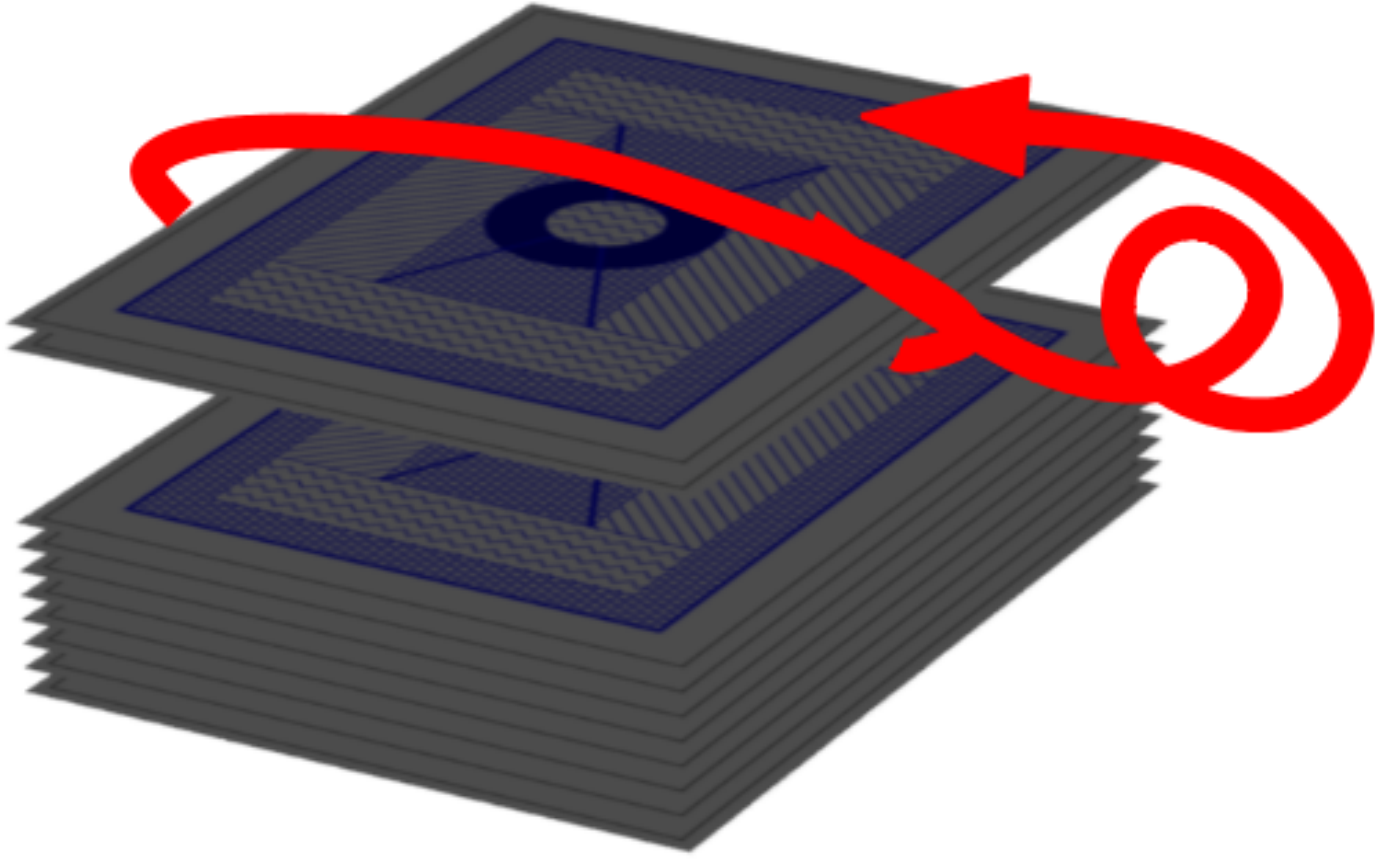


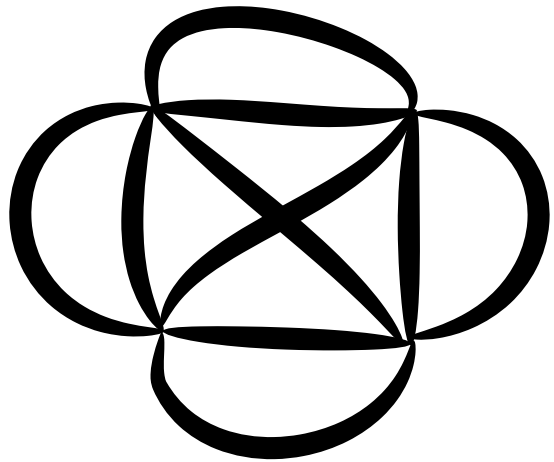
12+2=14

Instructions

- Give a random cut.
- Remember the bottom card.
- Take the top card to the bottom.
- Flip the top card.
- Random cut.
- Flip top two cards together.
- Repeat the above two steps 3 times.
- Give me the packet.

14+2=16

Looks familiar?



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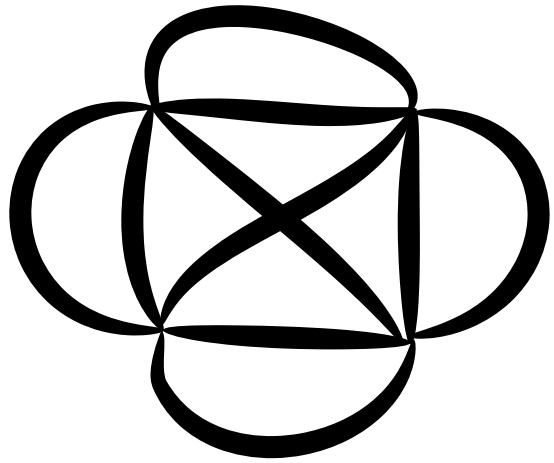


Draw this in one go without lifting pen and without retracing any line.

Euler's theorem

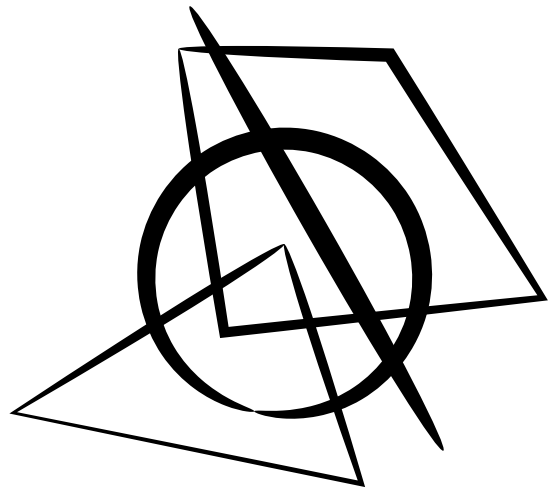
Consider a diagram consisting of some points joined by some lines such that you can go from any point to any other point. Then you can draw this diagram without lifting your pen and without reusing any line if and only if

either
only an even number of lines meet at each point

or
an odd number of lines meet at exactly two points

18+2=20

An example



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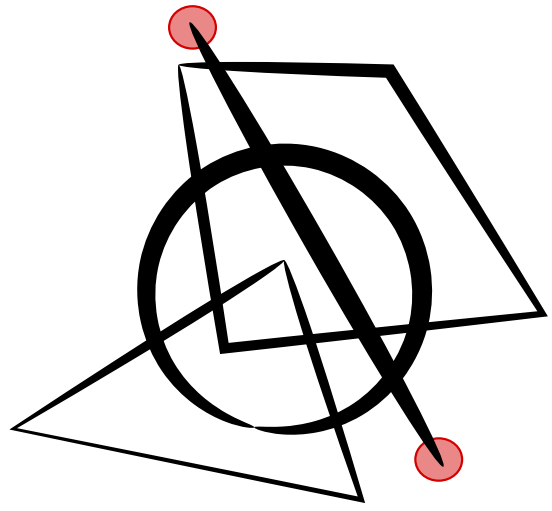
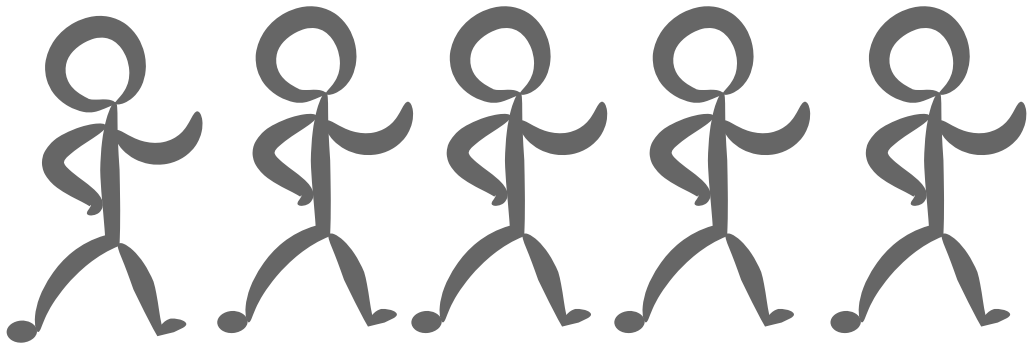


20+2=22

Mind reading magic

22+2=24

Did I do it without any information?



22+2=24

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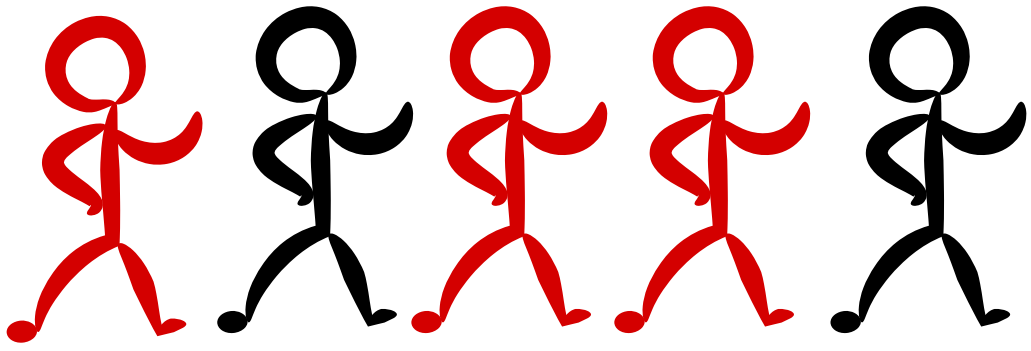

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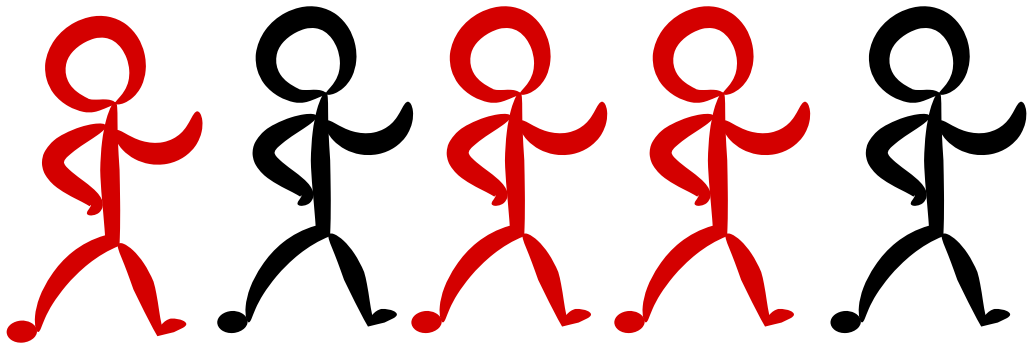

How many such patterns are possible?

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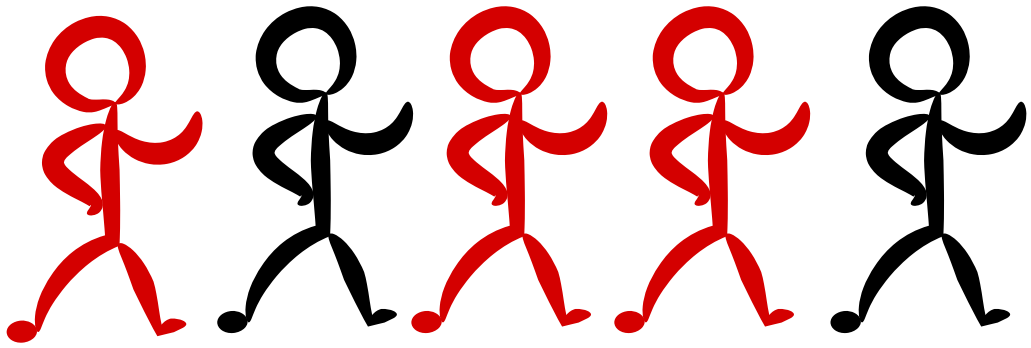

How many such patterns are possible?

Ans: 2^5.

24+2=26

A deck of (at most) 32 cards

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Hmmm...so you used an arranged deck!

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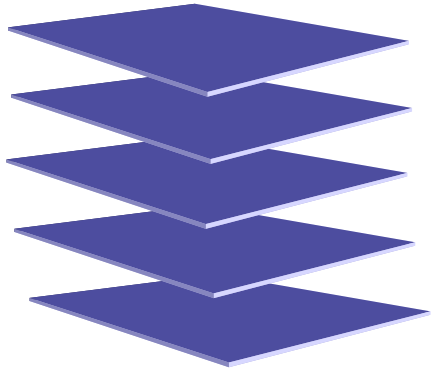

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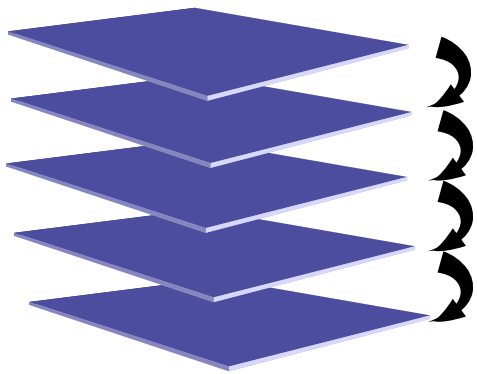

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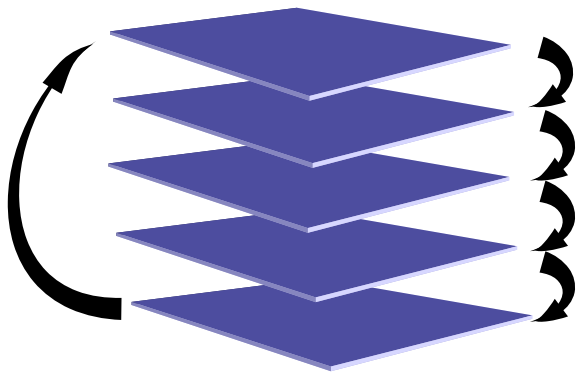

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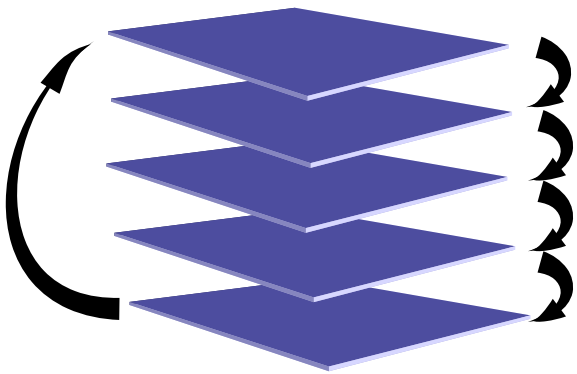

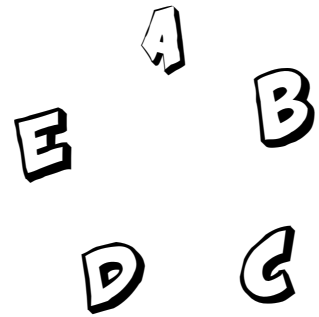

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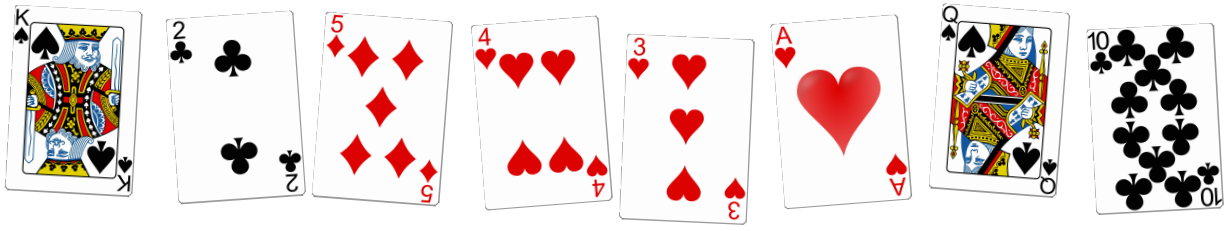

$2^3 = 8$ **cards**

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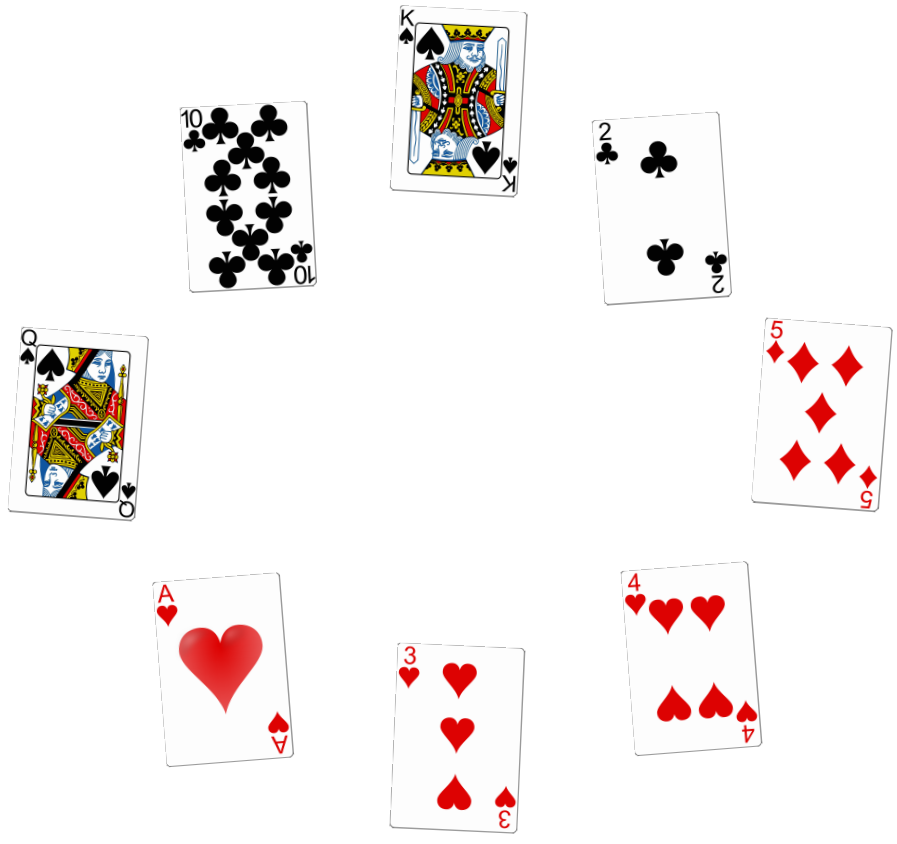

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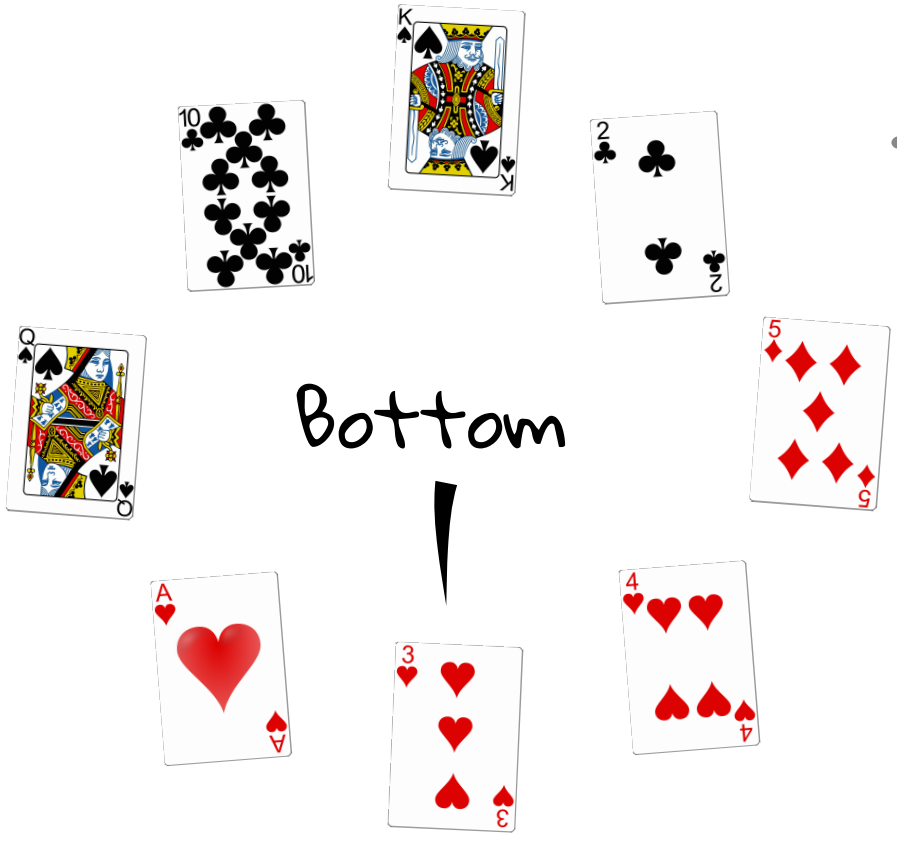

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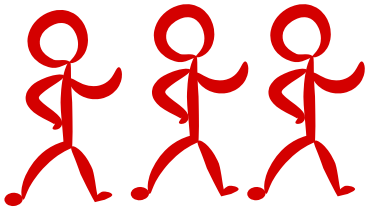

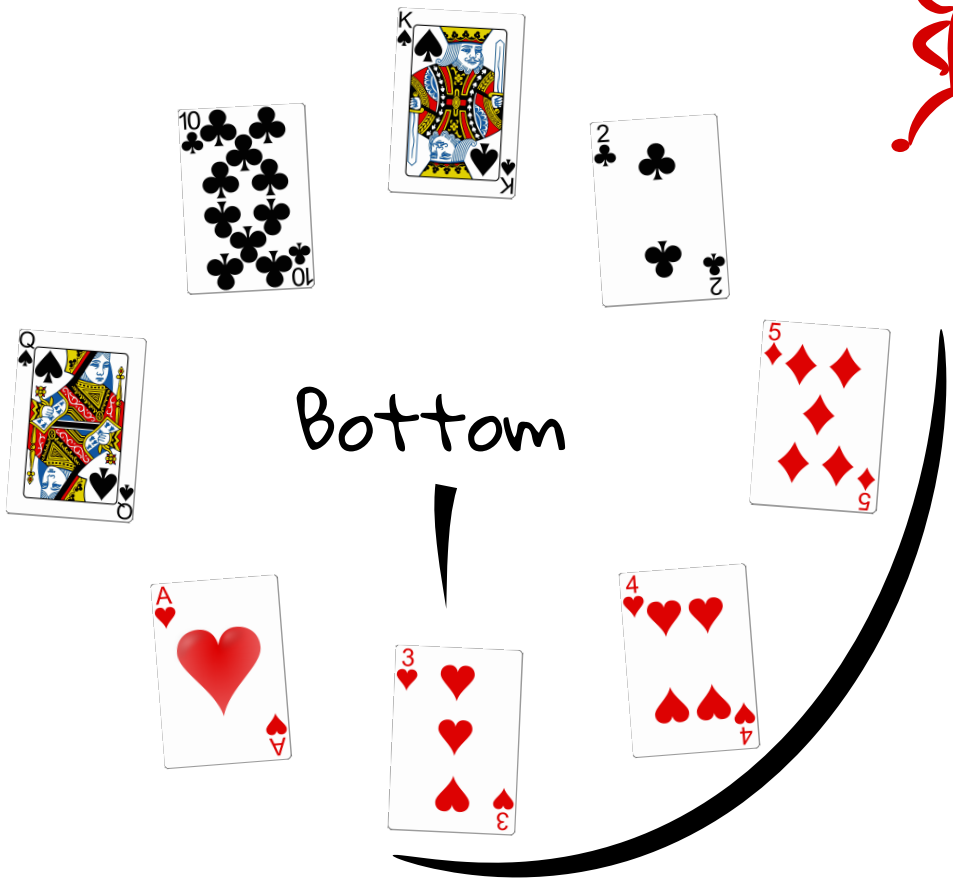

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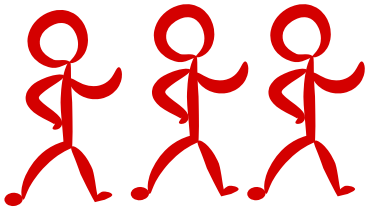

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So we need...

...a cyclical pattern where all consecutive triples have distinct red-black patterns.

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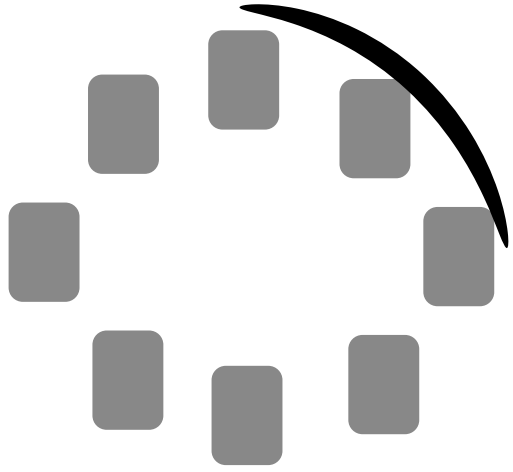

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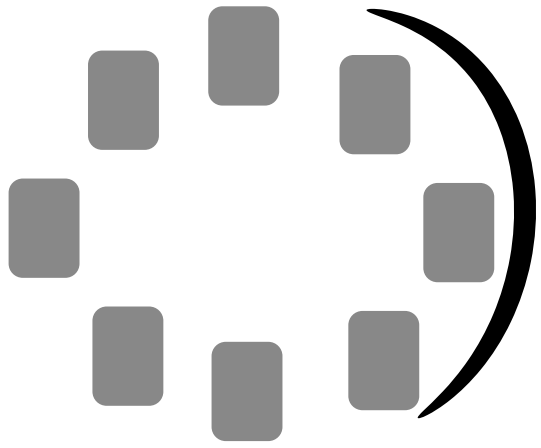

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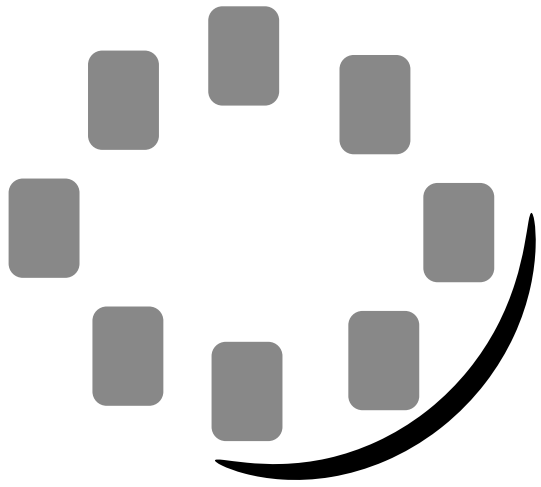

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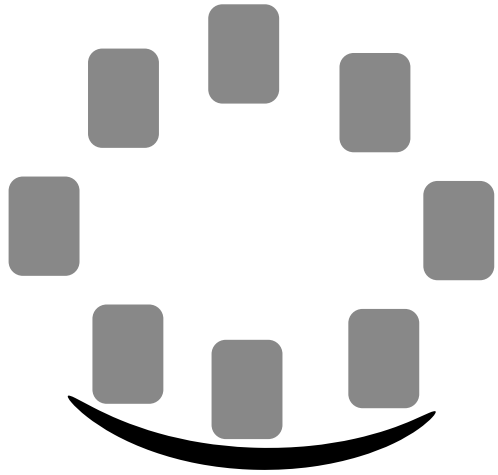

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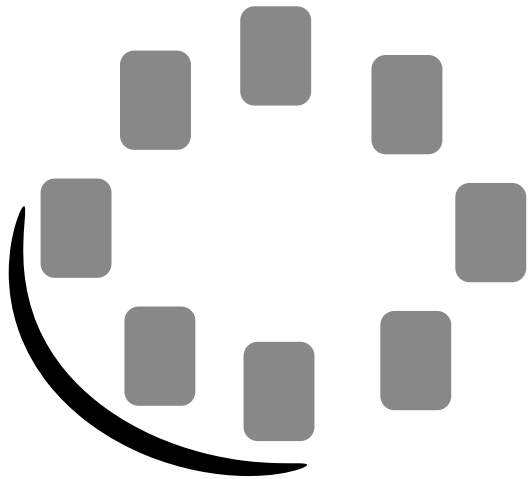

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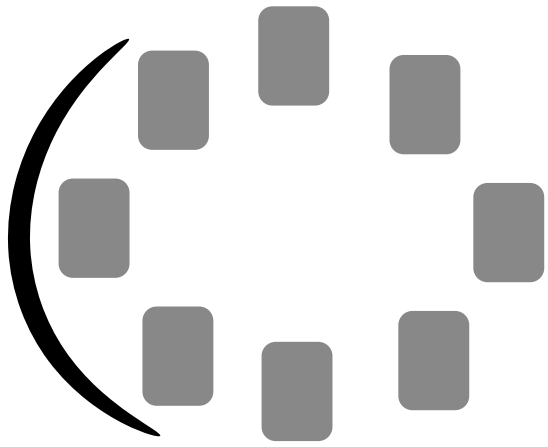

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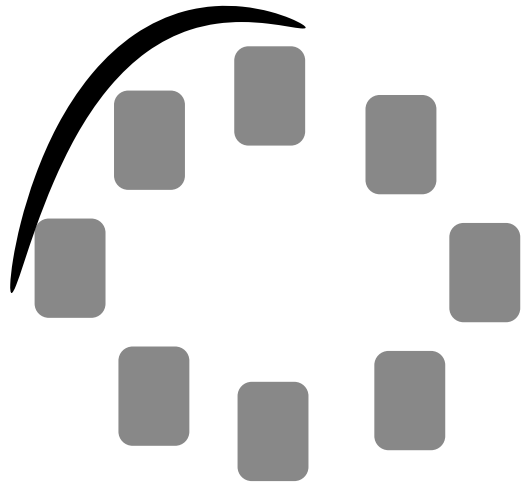

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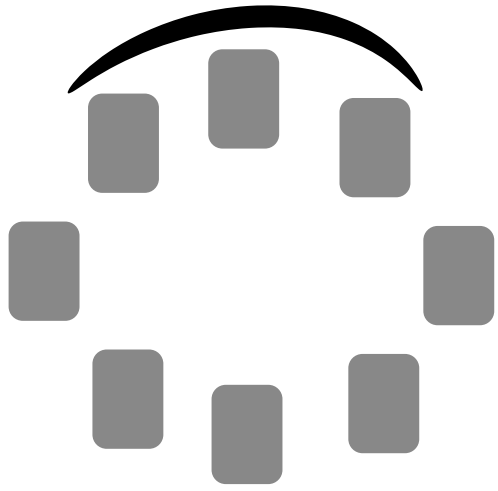

How to find such a pattern?

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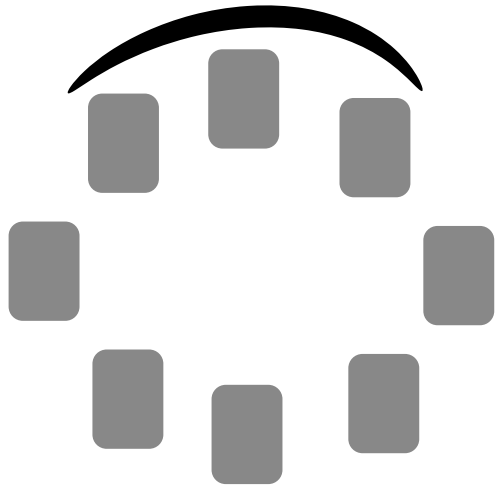

How to find such a pattern?
Does one really exist at all?