

Abacaba

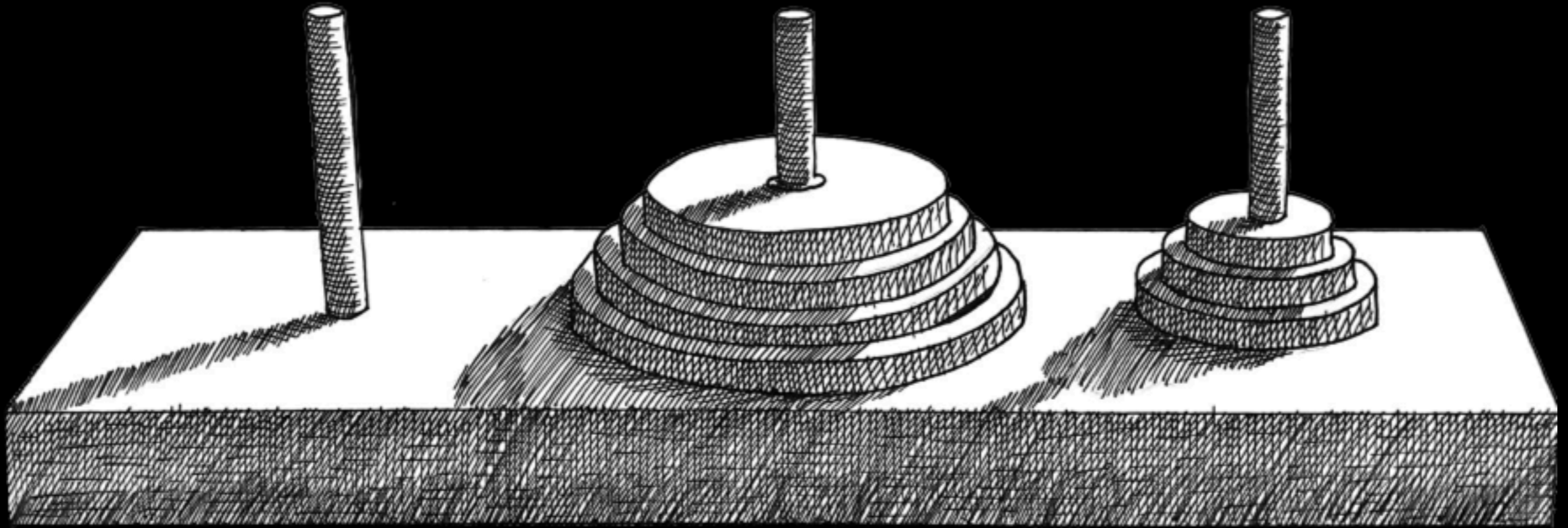
Mike Naylor

abacaba.org

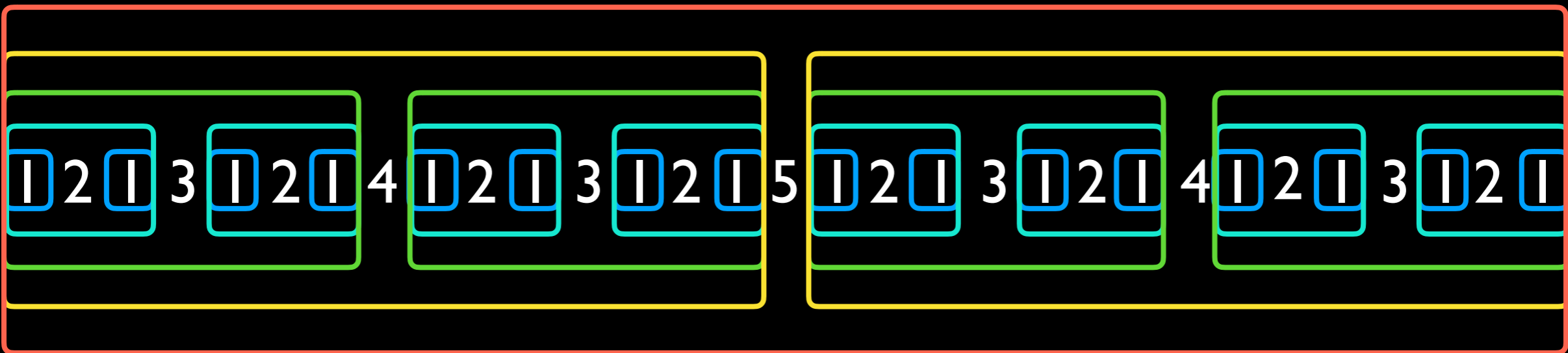
abacabax.com

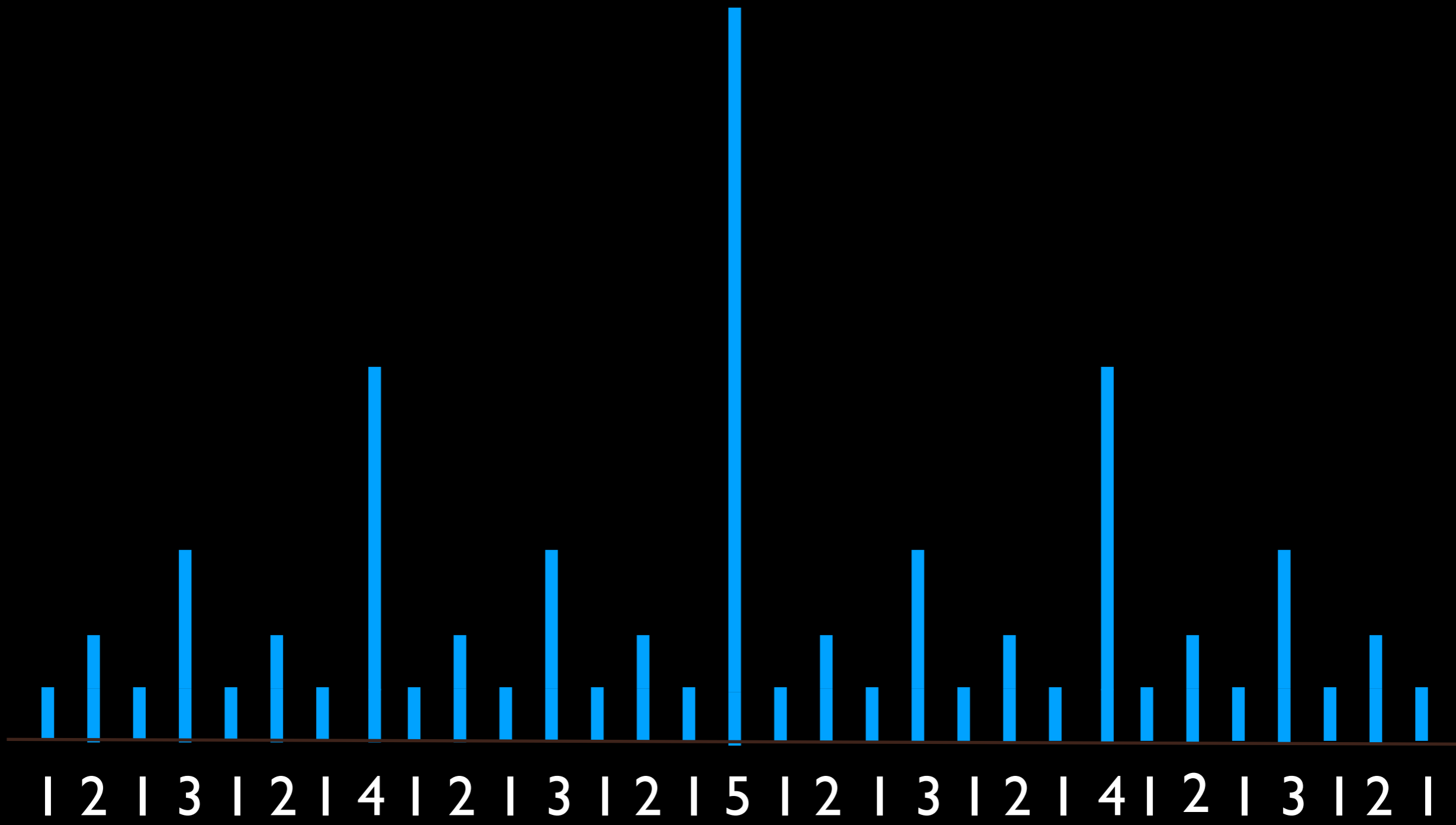
Artwork by Mike Naylor

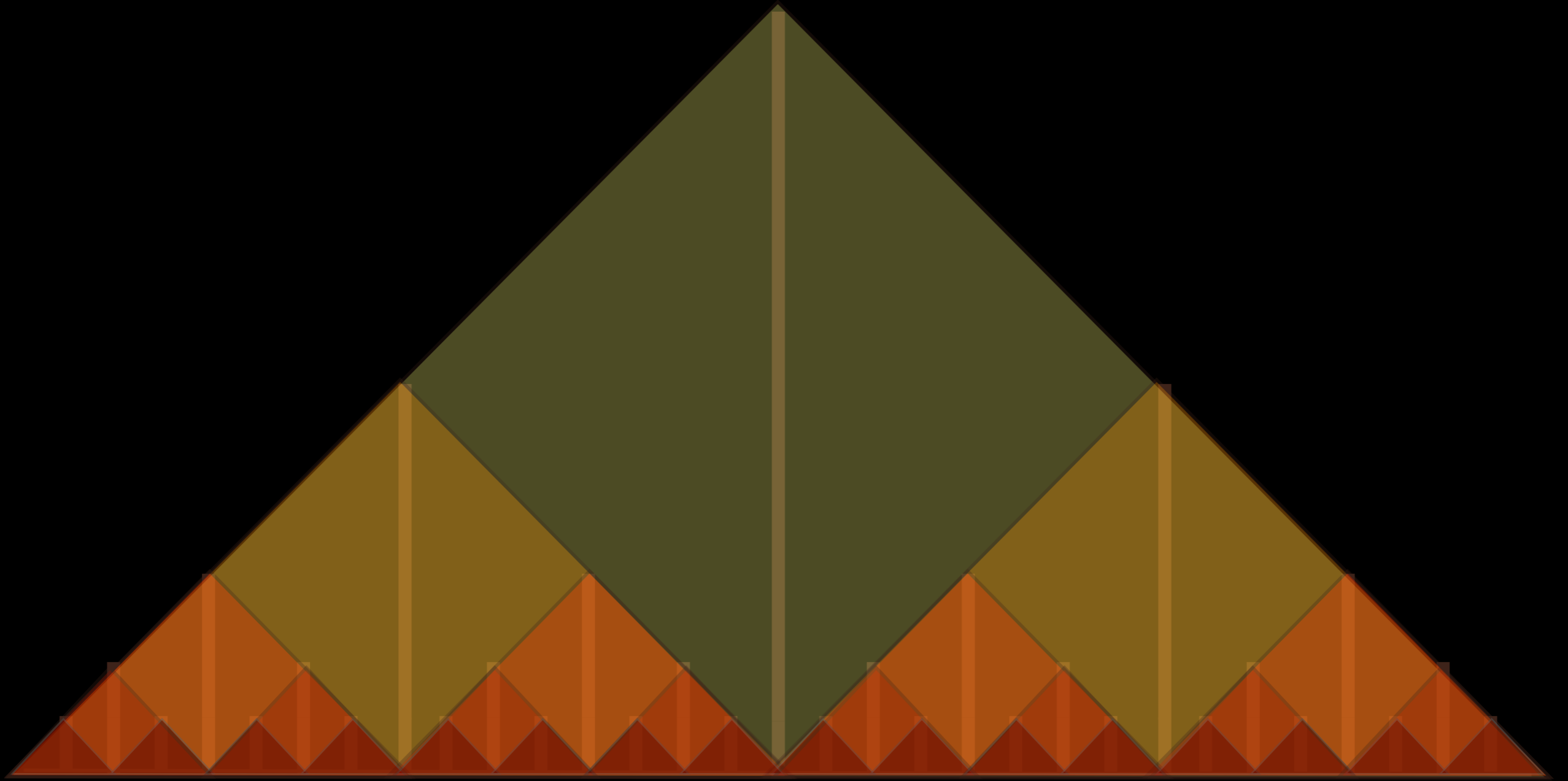
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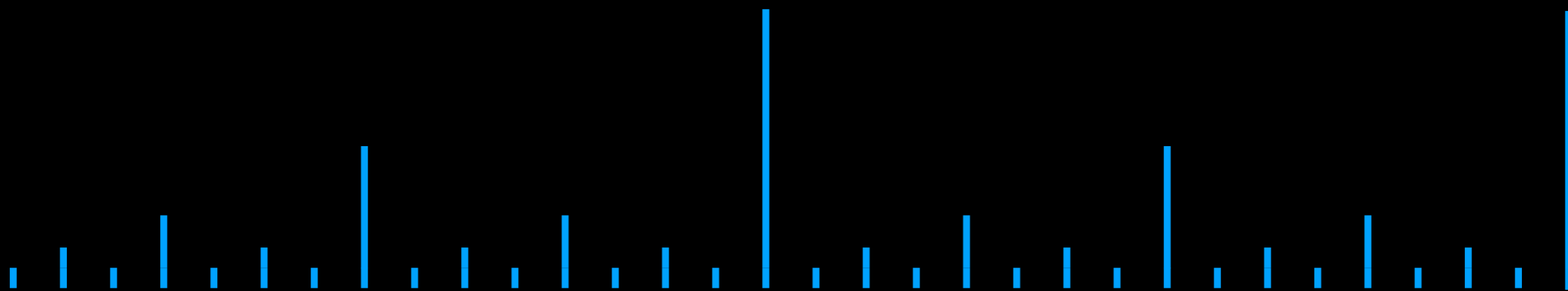


TOWERS OF HANOI





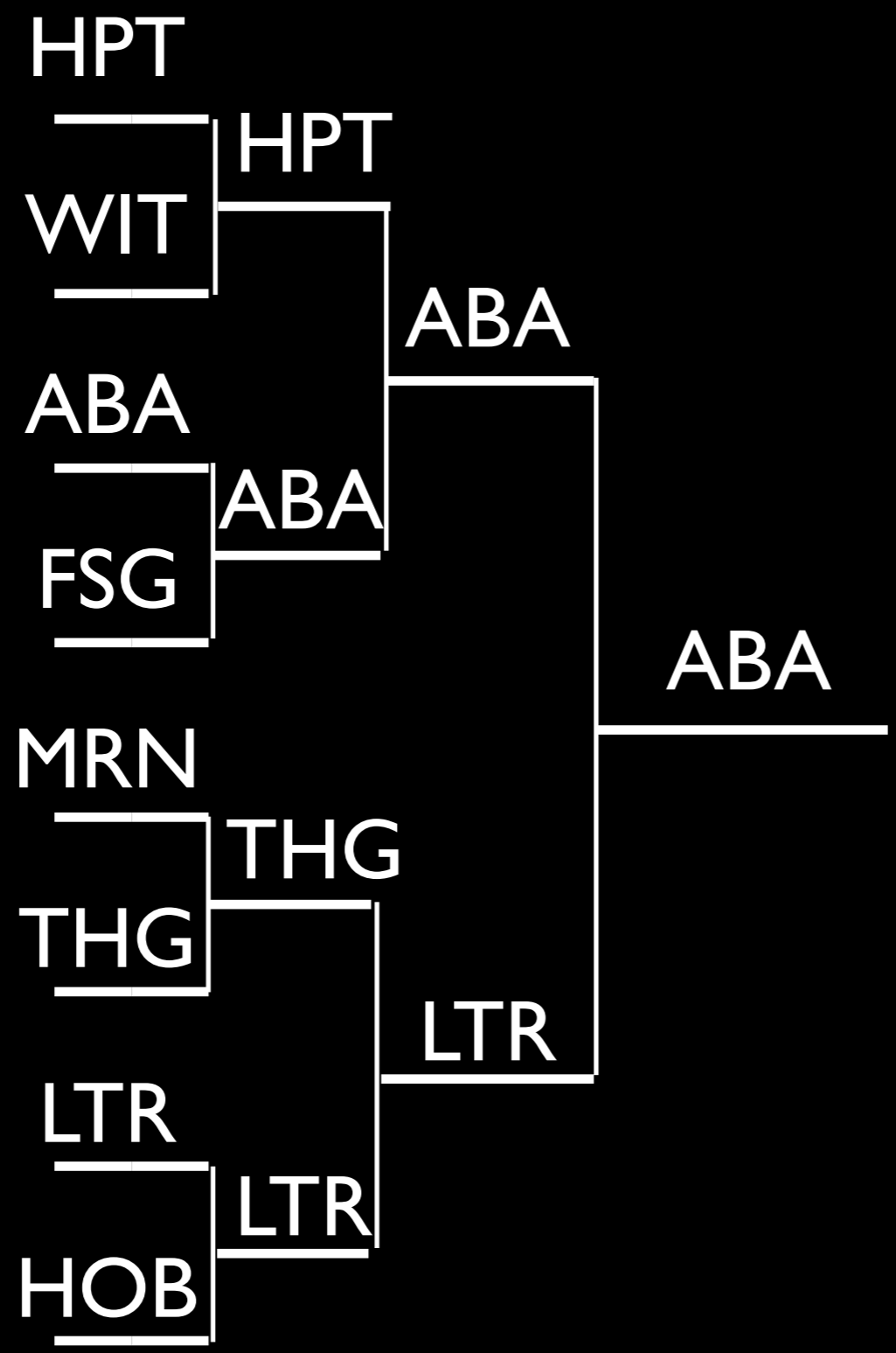


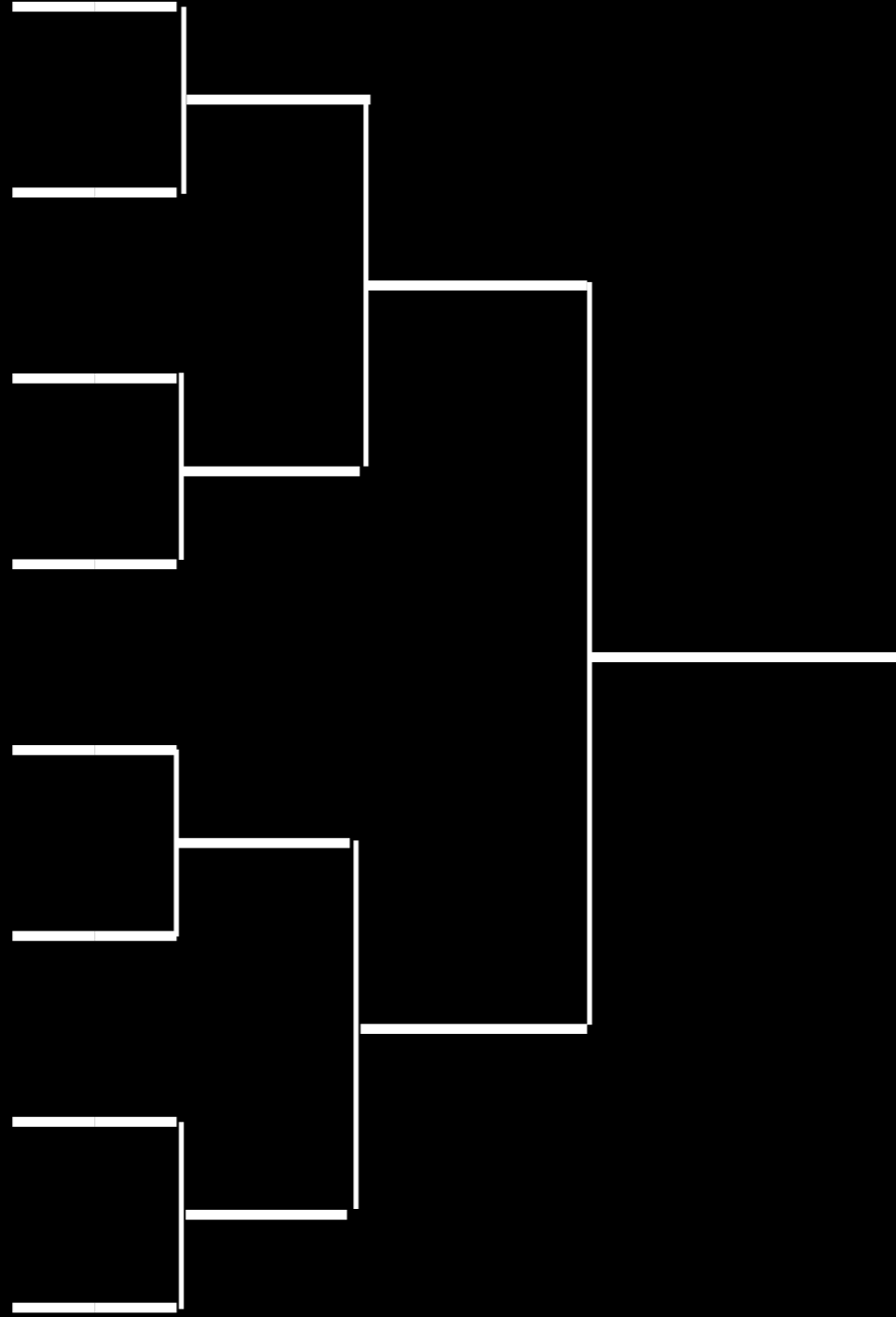


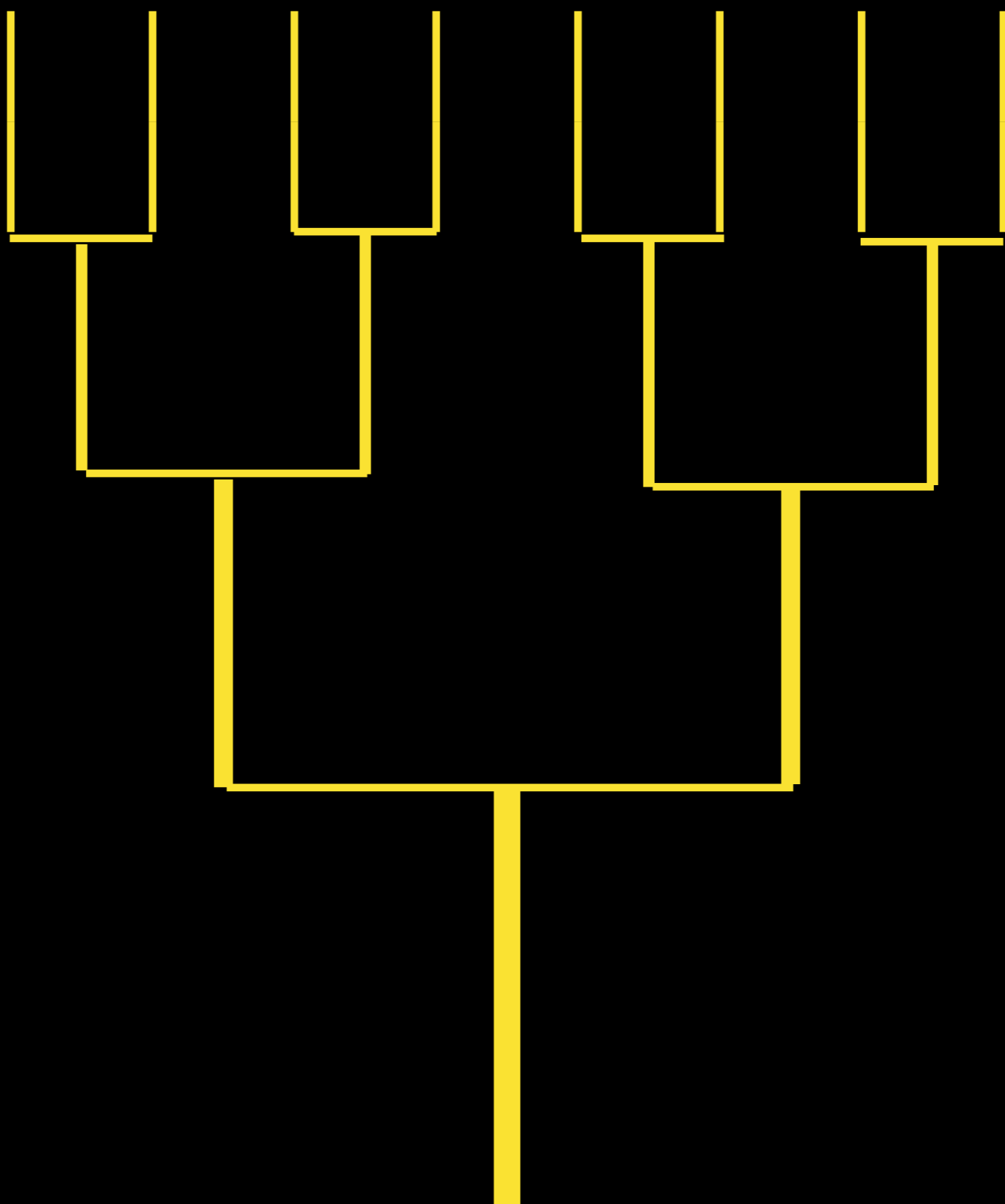
1

2

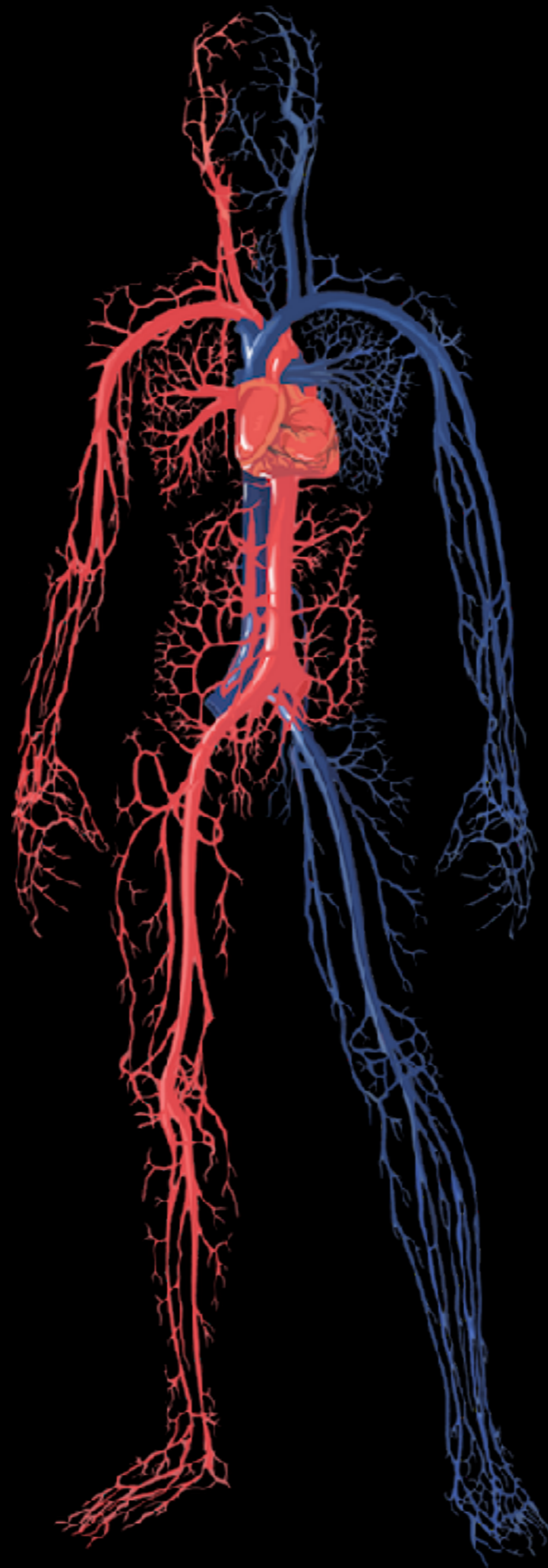


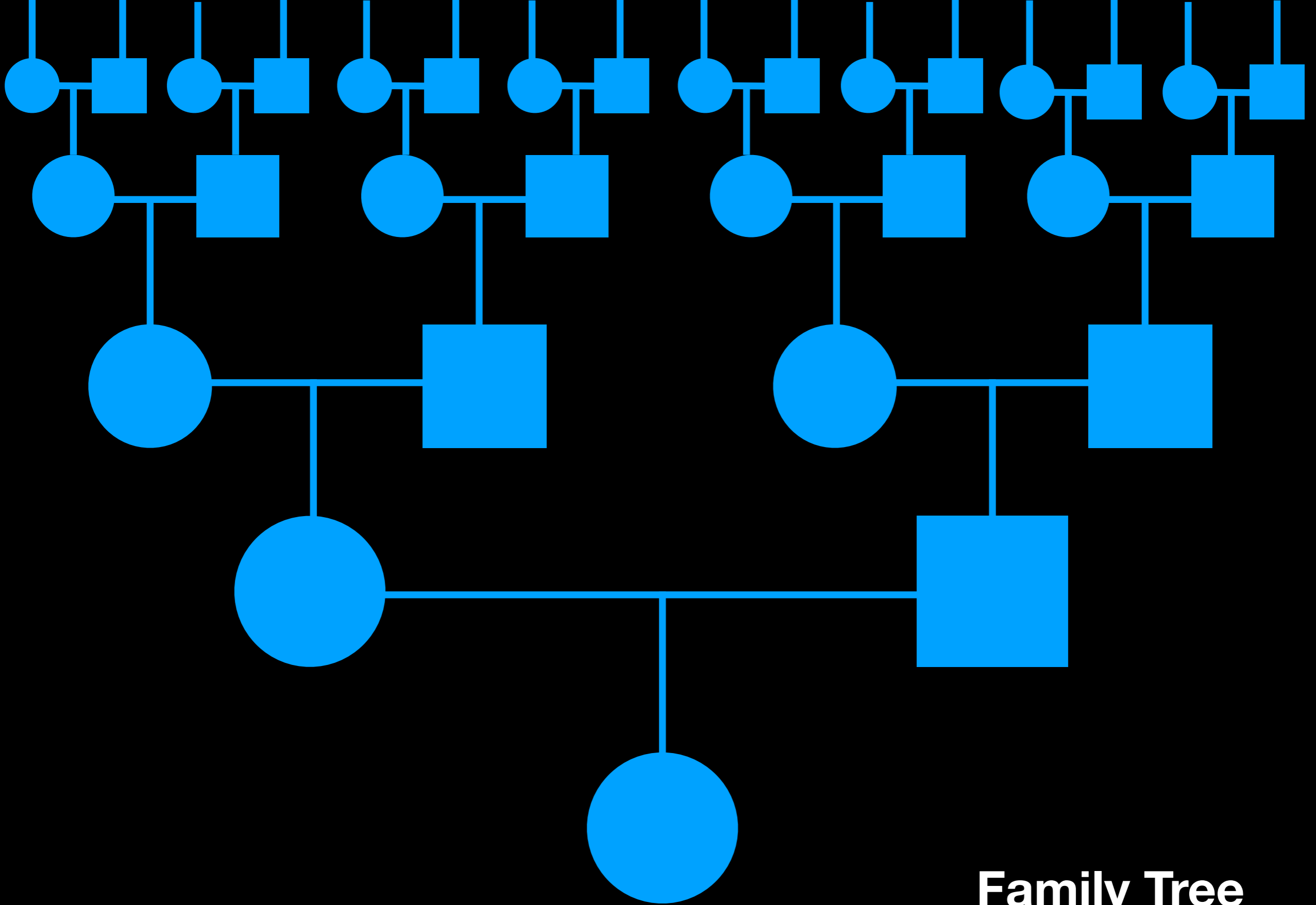










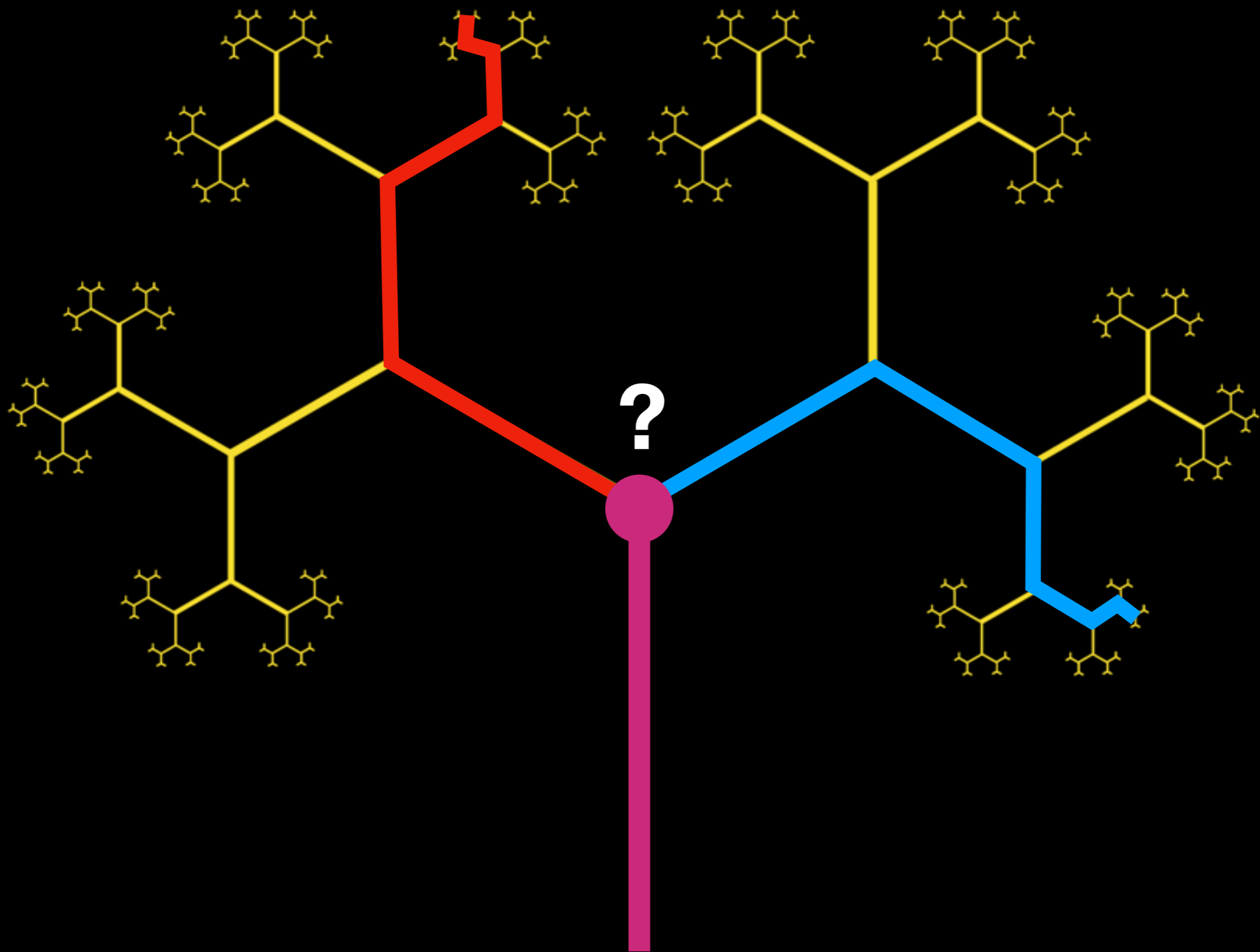


Family Tree

Family Tree 2
2020







“ Decision ”

Should I do it?

Should I not?

... .. Tree ”

And keep my conscience
clear and bright.

I'll do what I
know is right
Next time, who
knows? I just might!

I guess I'm doomed
to live this way.
Maybe on some
other day!

It wasn't worth it,
I would say.

But that's a tiny
price to pay!

How I
tomorrow
stay away.

They didn't catch
me yesterday!

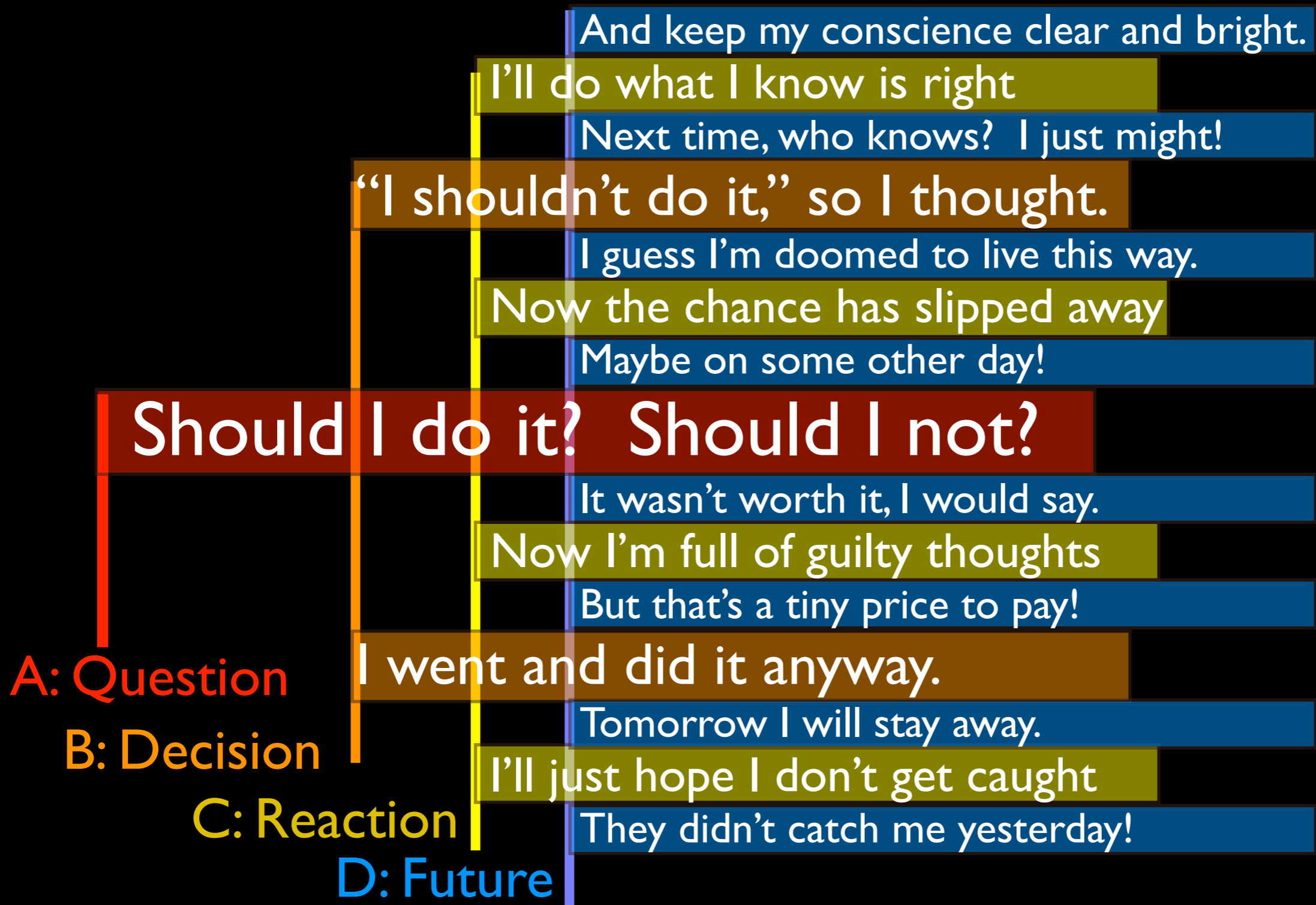
“I shouldn't do it”
so I thought.

I went and
did it anyway.

Now I'm full of
guilty thoughts

I'll just hope
I don't get caught

Decision Tree



Decision Tree

And keep my conscience clear and bright.
I'll do what I know is right
Next time, who knows? I just might!
“I shouldn't do it,” so I thought.
I guess I'm doomed to live this way.
Now the chance has slipped away
Maybe on some other day!

Should I do it? Should I not?

It wasn't worth it, I would say.

Now I'm full of guilty thoughts

But that's a tiny price to pay!

I went and did it anyway.

Tomorrow I will stay away.

I'll just hope I don't get caught

They didn't catch me yesterday!

Decision Tree

And keep my conscience clear and bright.
I'll do what I know is right
Next time, who knows? I just might!

"I shouldn't do it," so I thought.

I guess I'm doomed to live this way.

Now the chance has slipped away

Maybe on some other day!

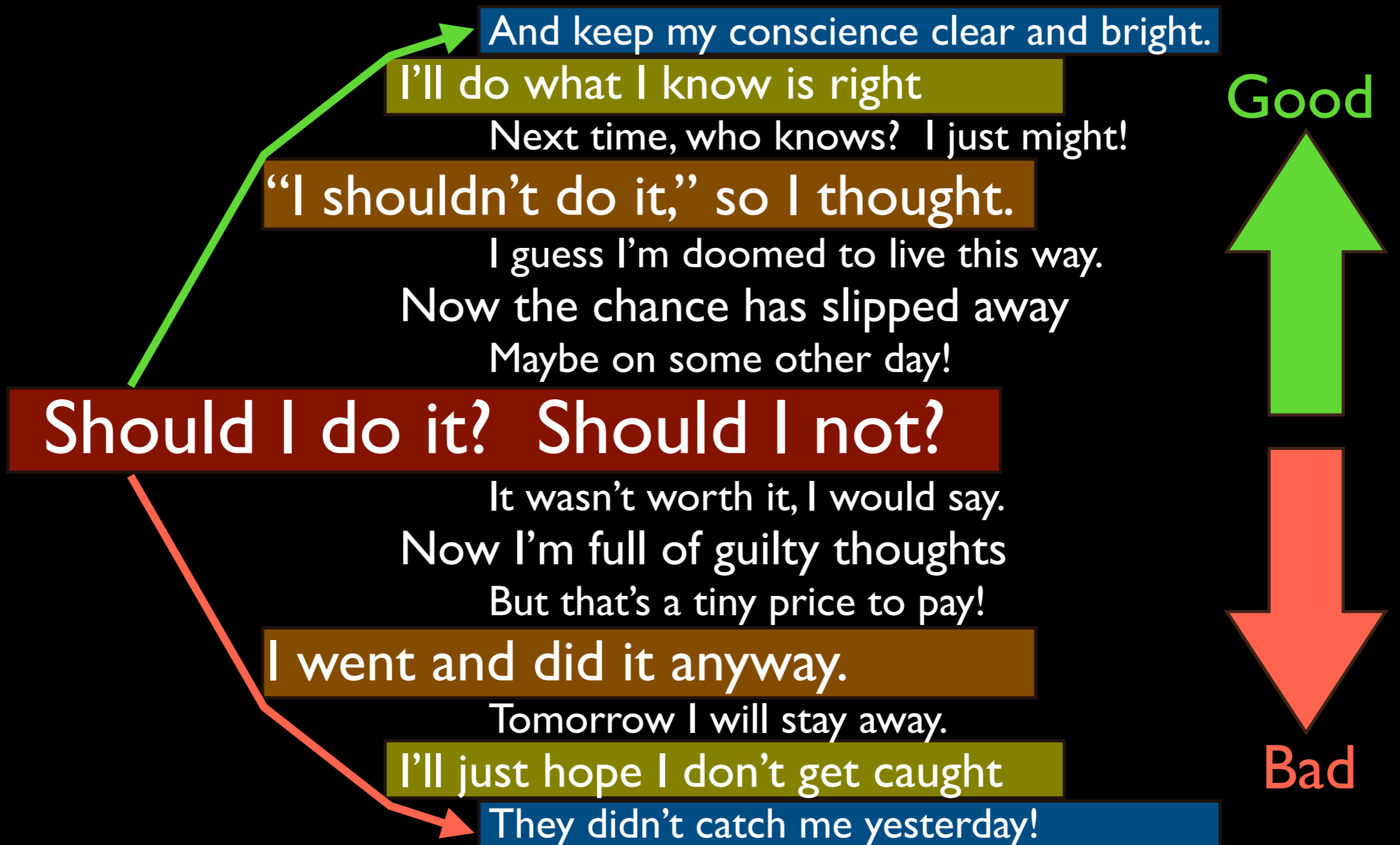
Should I do it? Should I not?

It wasn't worth it, I would say.
Now I'm full of guilty thoughts
But that's a tiny price to pay!

I went and did it anyway.

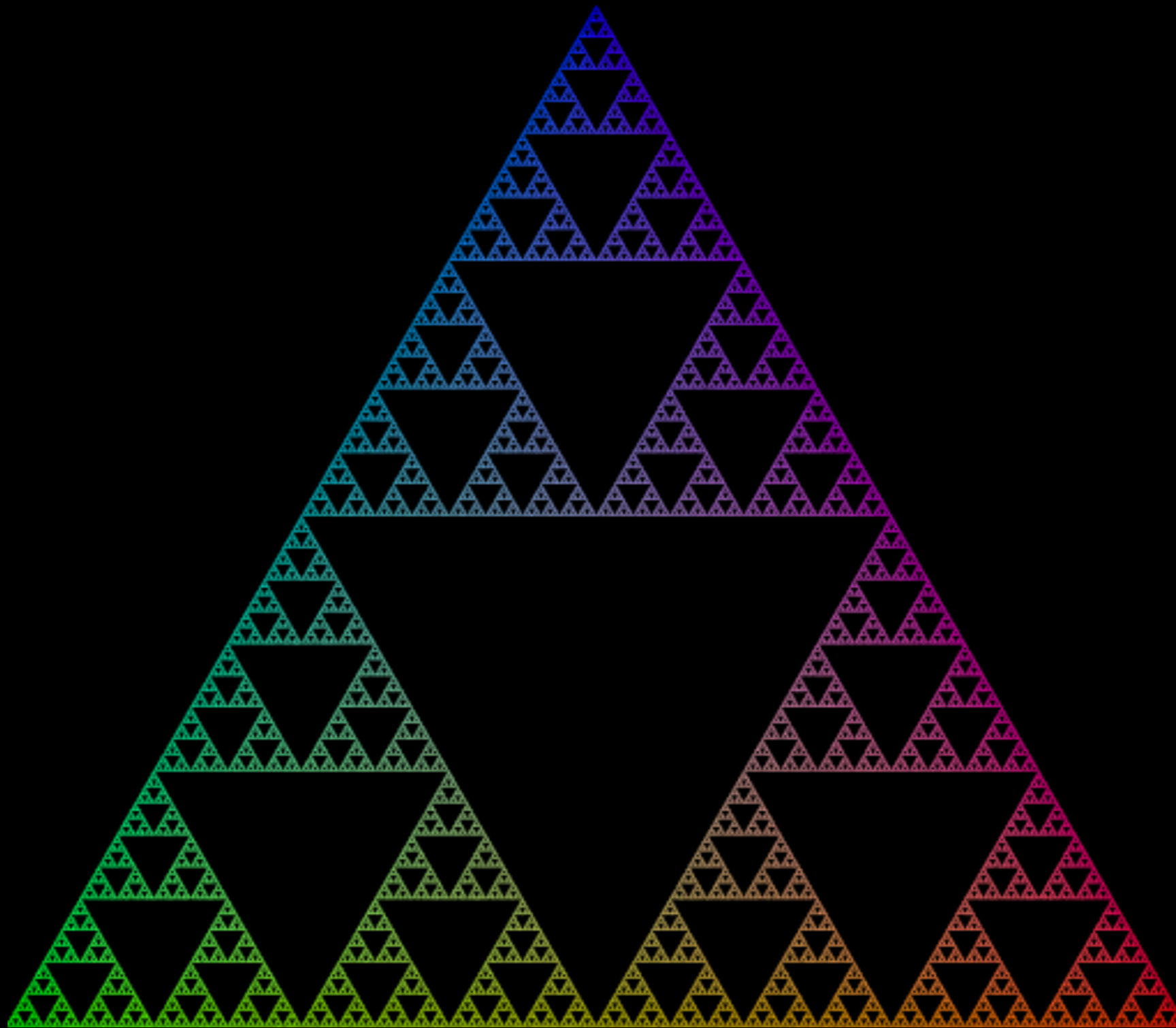
Tomorrow I will stay away.
I'll just hope I don't get caught
They didn't catch me yesterday!

Decision Tree

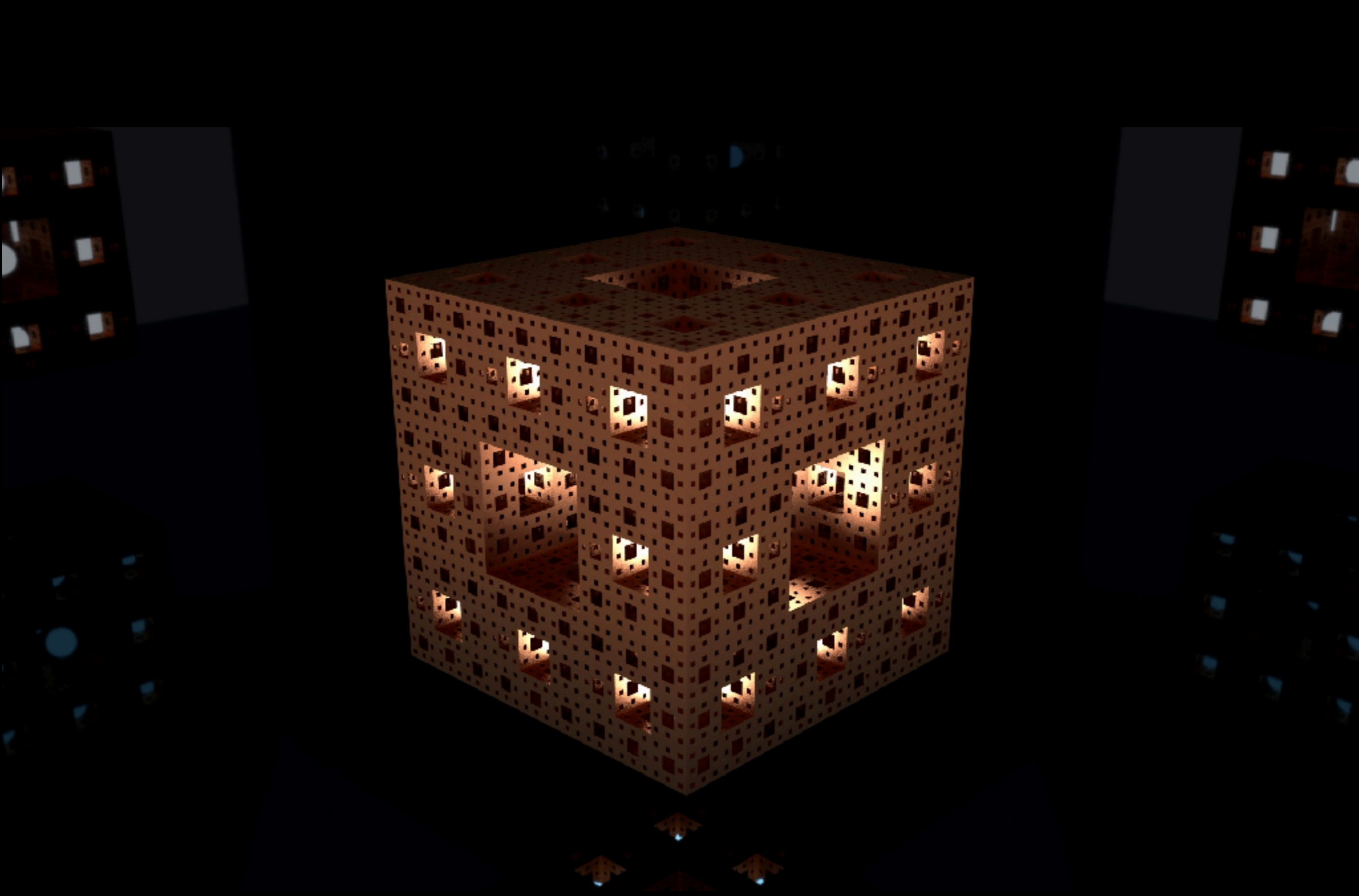




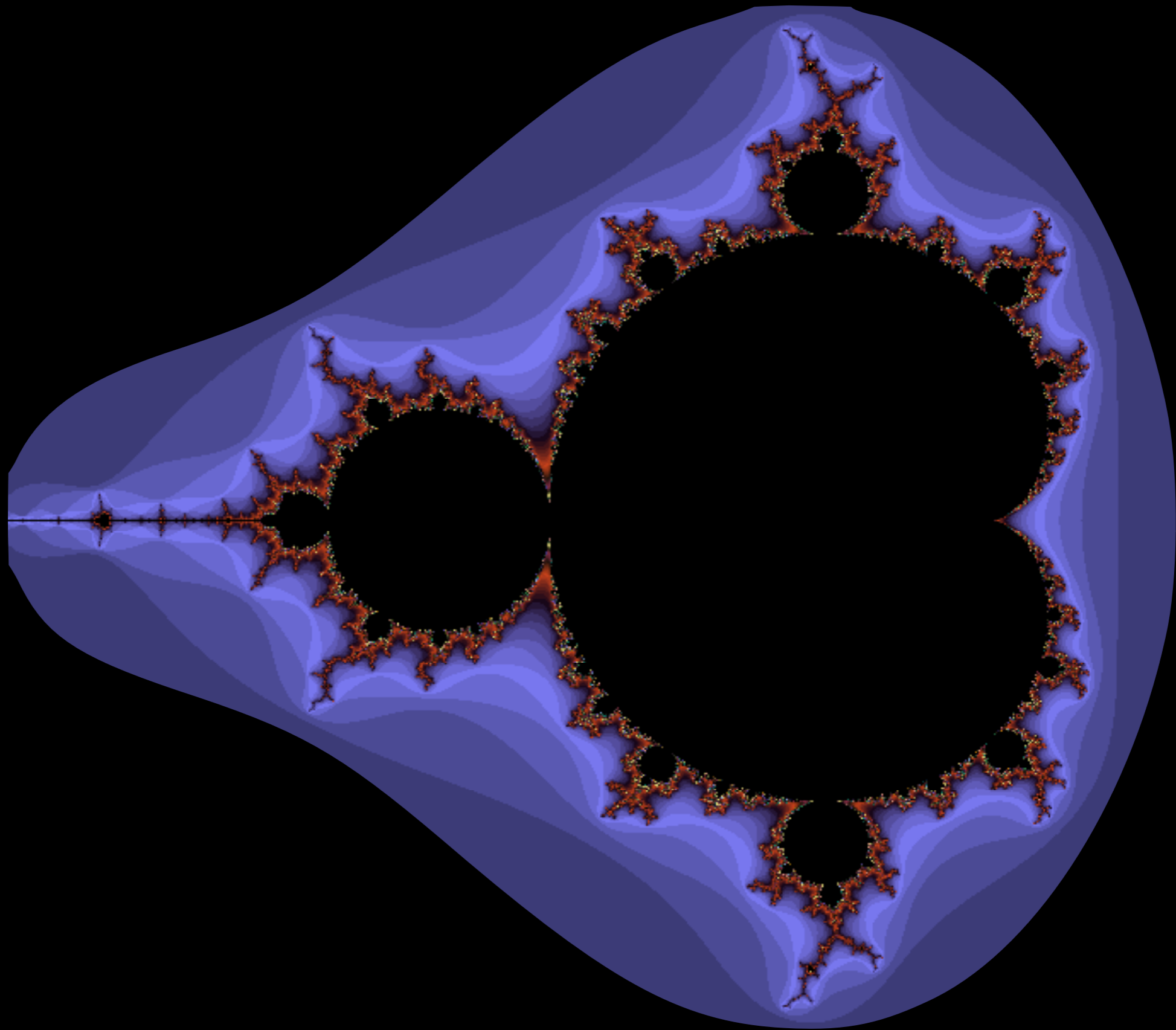
Cantor set



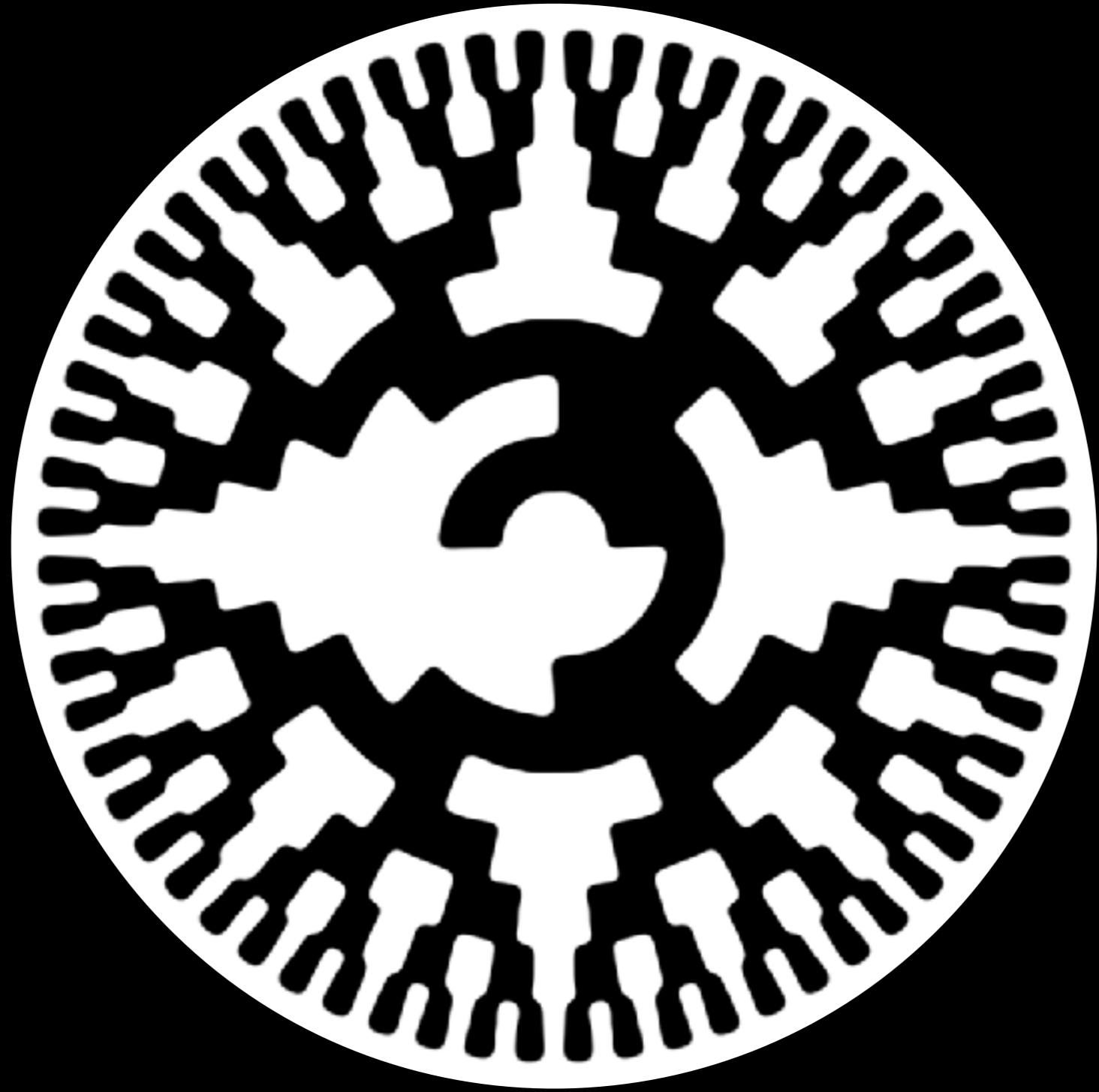
Sierpinski triangle



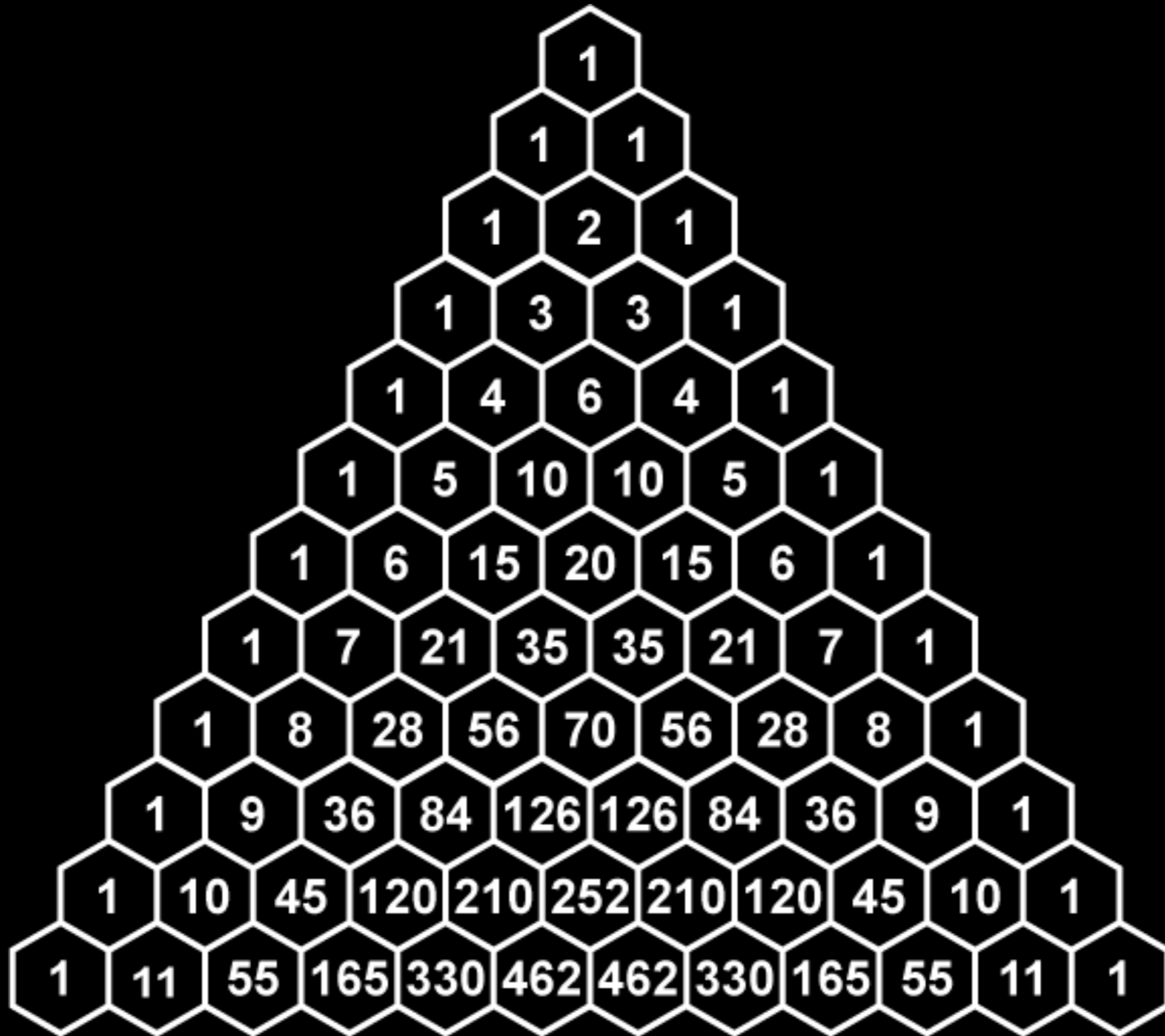
Menger sponge



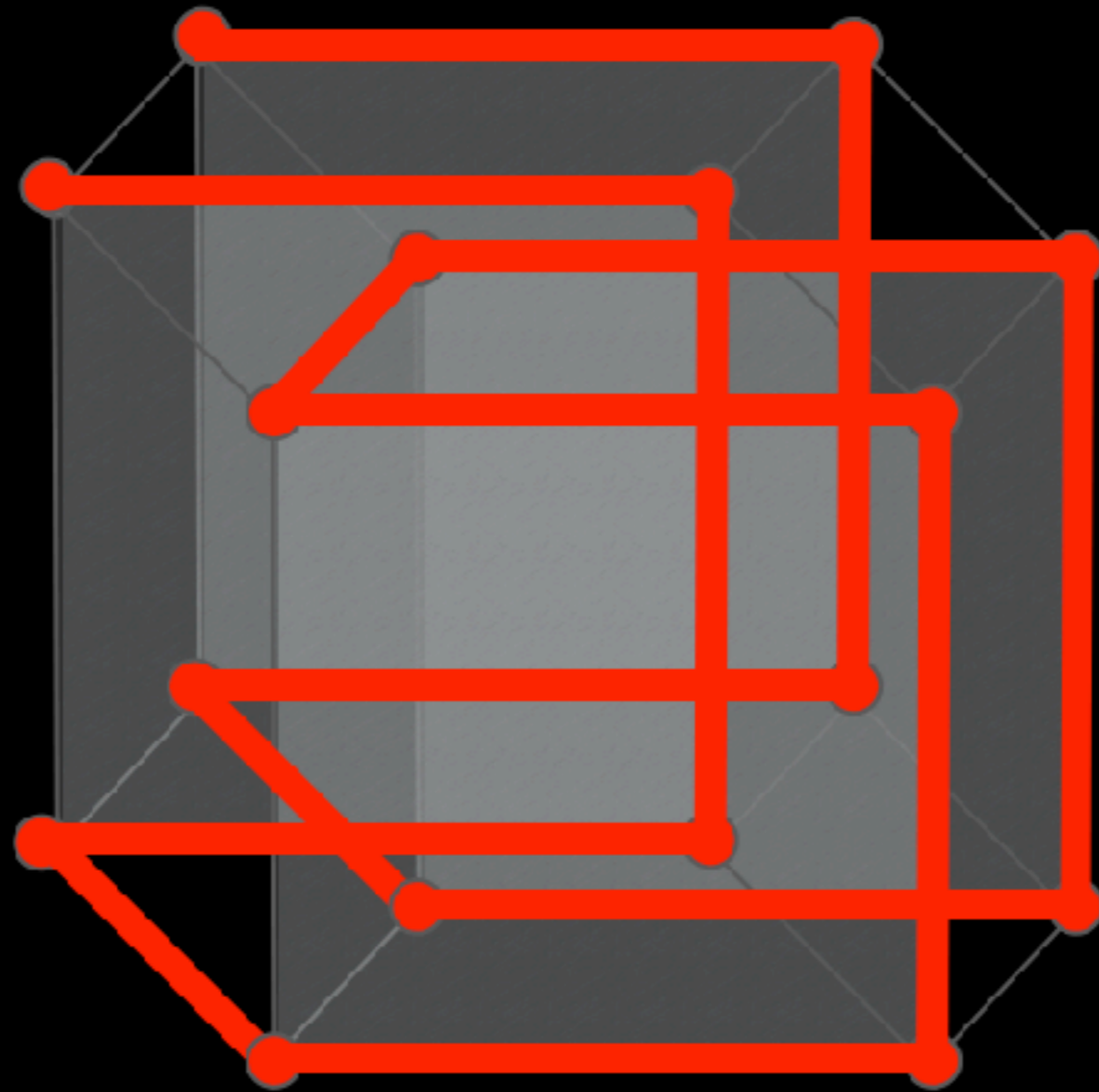
Mandelbrot set



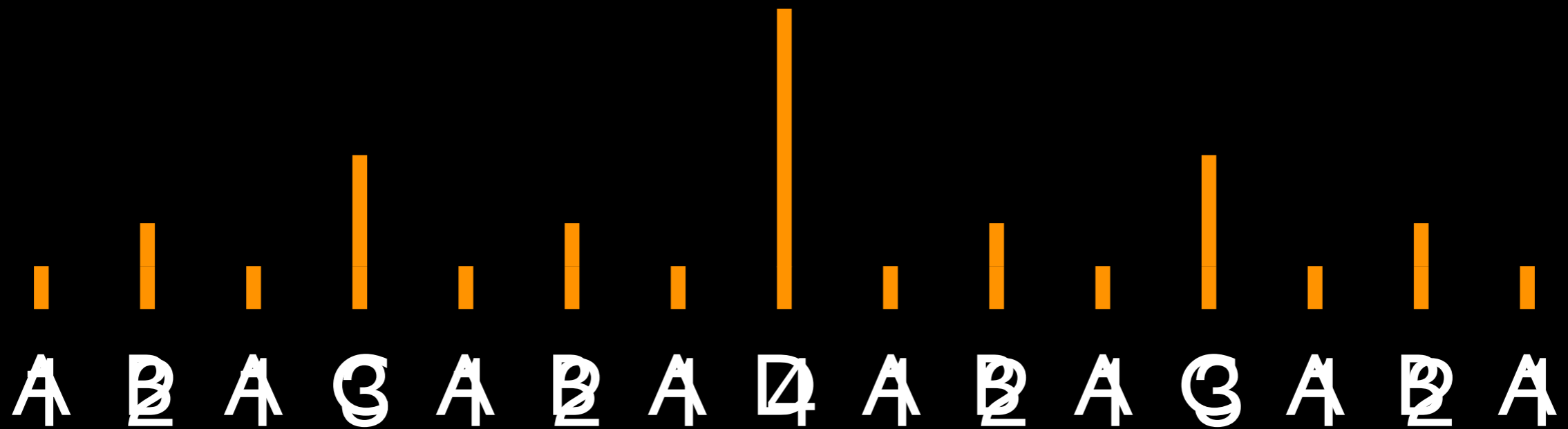
Gray code



Pascal's triangle



Hypercubes



“ABACABA pattern”

A

ABA

ABACABA

ABACABADABACABA

ABACABADABACABA E ABACABADABACABA

ABACABADABACABA
EABACABADABACABA
FABACABADABACABA
EABACABADABACABA

ABACABADABACABA
EABACABADABACABA
FABACABADABACABA
EABACABADABACABA
GABACABADABACABA
EABACABADABACABA
FABACABADABACABA
EABACABADABACABA

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EABACABADABACABA
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EABACABADABACABA
FABACABADABACABA
EABACABADABACABA

HABACABADABACABA
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EABACABADABACABA
GABACABADABACABA
EABACABADABACABA
FABACABADABACABA
EABACABADABACABA

ABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA
GABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA

HABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA
GABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA

I ABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA
GABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA

HABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA
GABACABADABACABA EABACABADABACABA
FABACABADABACABA EABACABADABACABA

word	# letters
A	1
ABA	3
ABACABA	7
ABA...D...ABA	15
ABA...E...ABA	31
ABA...F...ABA	63
...G...	127
...H...	255
...I...	511
...J...	1,023
K	2,047
L	4,095
M	8,191

word	# letters
N	16,383
O	32,767
P	65,535
Q	131,071
R	262,143
S	524,287
T	1,048,575
U	2,097,151
V	4,194,303
W	8,388,607
X	16,777,215
Y	33,554,431
Z	67,108,863

Abacaba unabridged



Volume 1, Chapters 1-24
Michael Naylor

Abacaba unabridged



Volume 2, Chap
Michael Na

Abacaba unabridged



Volume 3, Cha
Michael

Abacaba unabridged



Volume 4, Chapter 26 part 2
Michael Naylor





Abacabax

version 1

Mike Naylor
www.abacabax.com

$\text{♩} = 140$

Ascension

Descension

25

31

Expansion

36

41

ritard.

"Abacaba"

Mike Naylor





Abacaba music machine
Mike Naylor 2019

Base 10
(decimal)

3 7 5

hundreds tens ones

3 hundreds + 7 tens + 5 ones

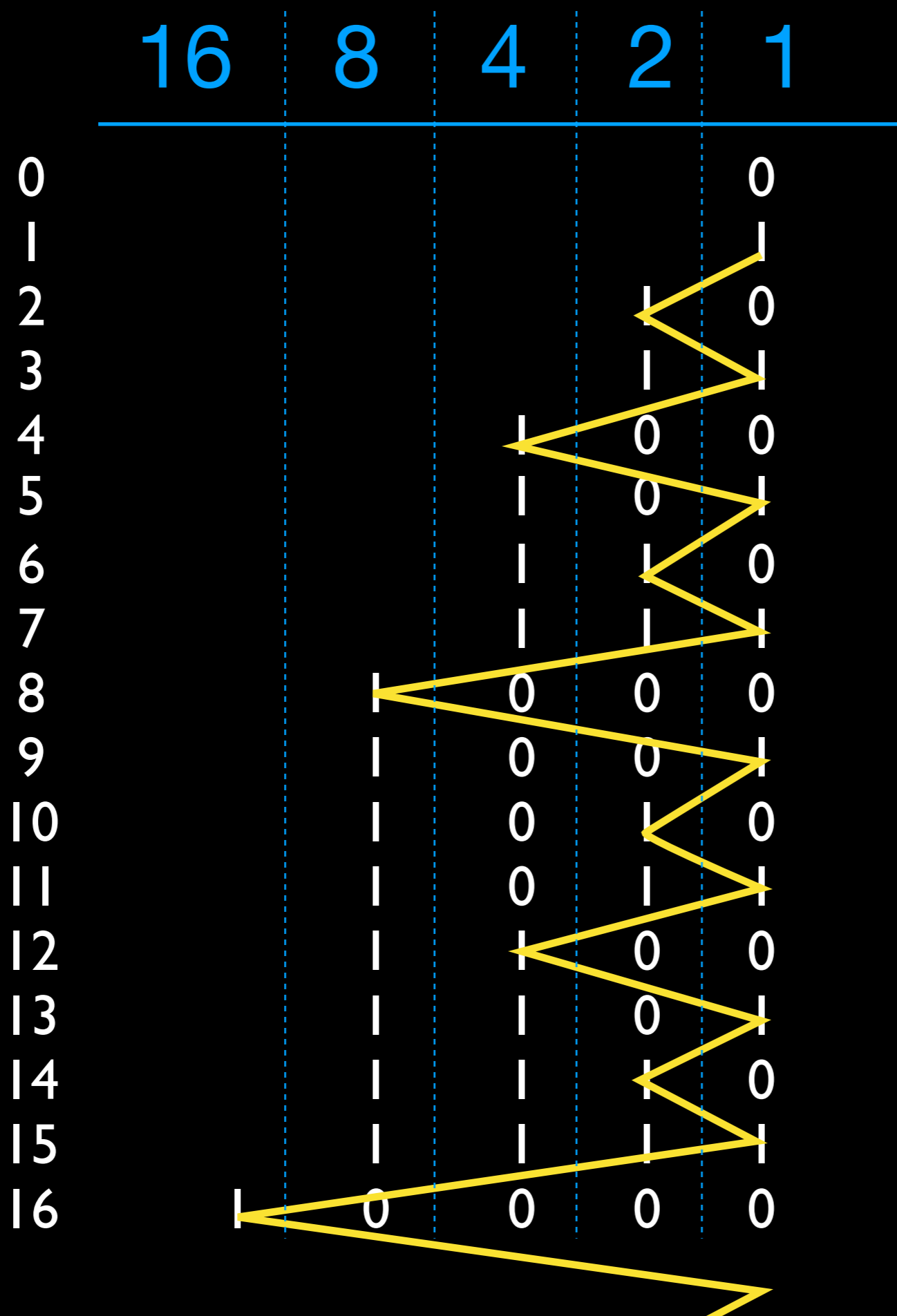
Base 2
(binary)

1 0 1 1

eight four two one

1 eight + 0 fours + 1 two + 1 one

	16	8	4	2	1
0					0
1					1
2				1	0
3				1	1
4			1	0	0
5			1	0	1
6			1	1	0
7			1	1	1
8		1	0	0	0
9		1	0	0	1
10		1	0	1	0
11		1	0	1	1
12		1	1	0	0
13		1	1	0	1
14		1	1	1	0
15		1	1	1	1
16	1	0	0	0	0

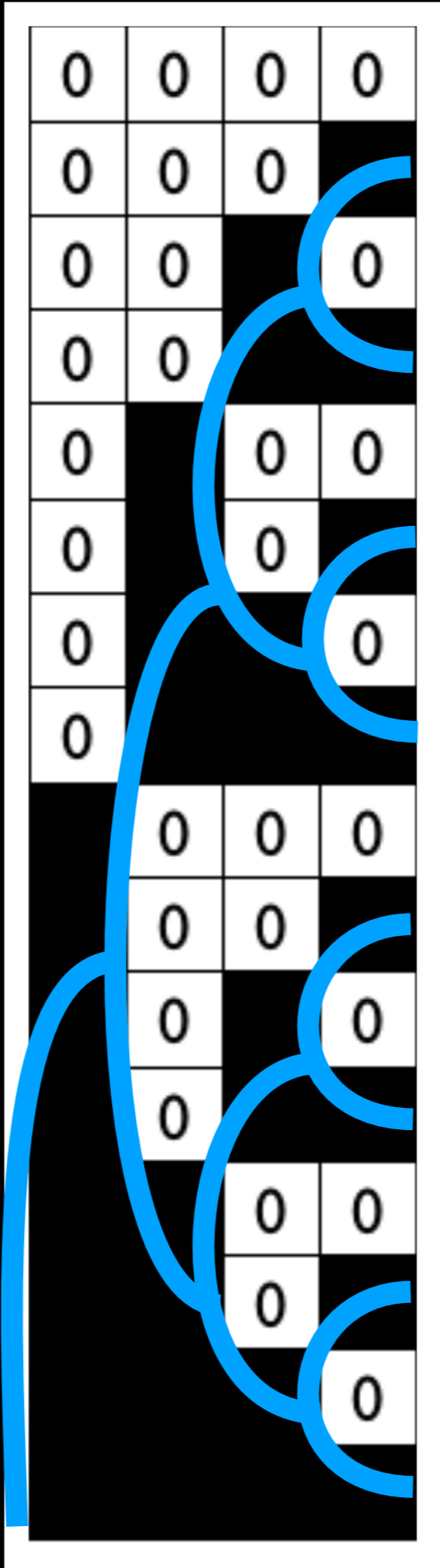


	16	8	4	2	1
0					0
1					1
2				1	0
3				1	1
4			1	0	0
5			1	0	1
6			1	1	0
7			1	1	1
8		1	0	0	0
9		1	0	0	1
10		1	0	1	0
11		1	0	1	1
12		1	1	0	0
13		1	1	0	1
14		1	1	1	0
15		1	1	1	1
16	1	0	0	0	0

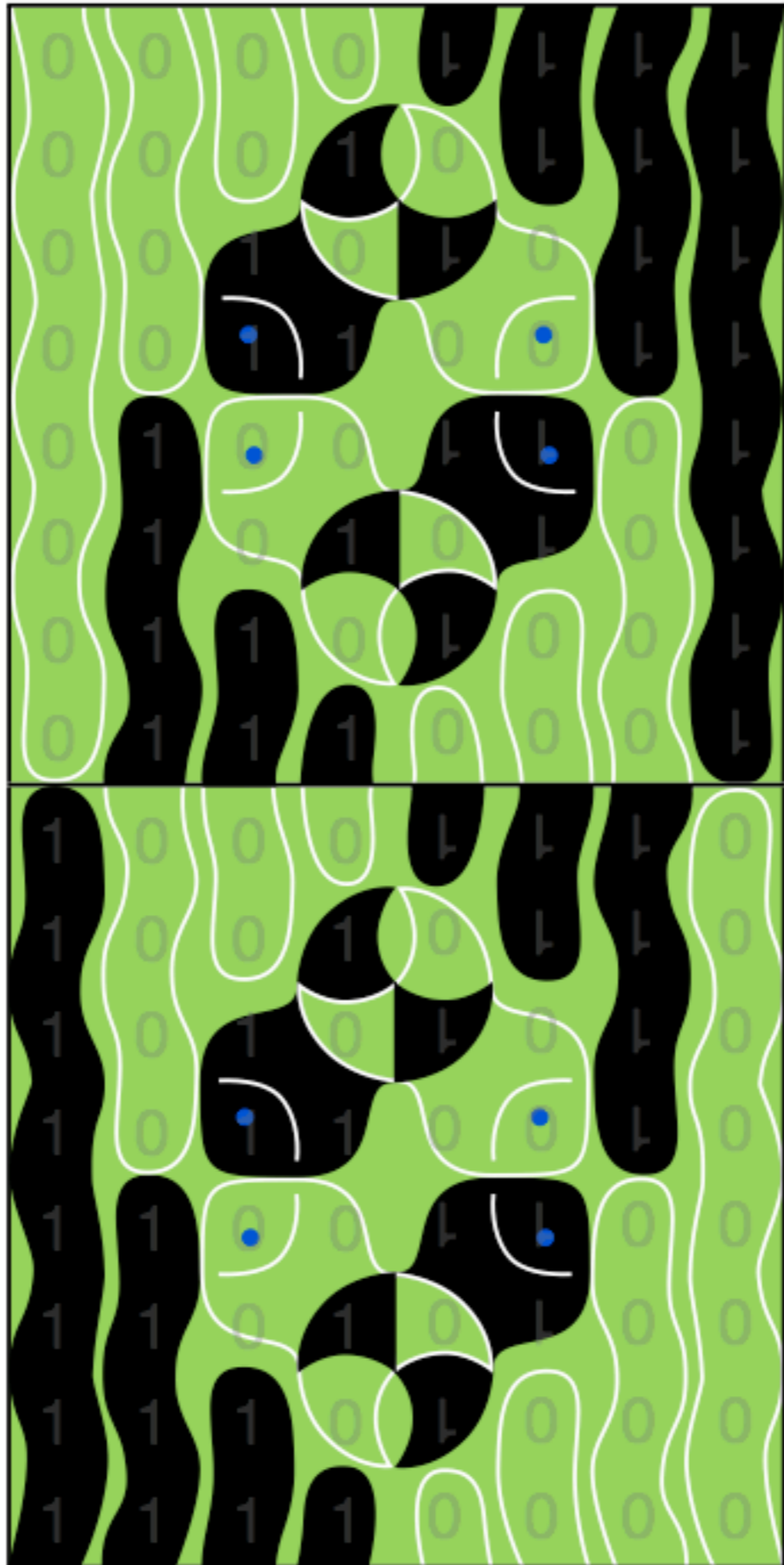
	16	8	4	2	1	
0					0	1 bit change
1					1	2 bit change
2				1	0	1 bit change
3				1	1	3 bit change
4			1	0	0	1 bit change
5			1	0	1	2 bit change
6			1	1	0	1 bit change
7			1	1	1	4 bit change
8		1	0	0	0	1 bit change
9		1	0	0	1	2 bit change
10		1	0	1	0	1 bit change
11		1	0	1	1	3 bit change
12		1	1	0	0	1 bit change
13		1	1	0	1	2 bit change
14		1	1	1	0	1 bit change
15		1	1	1	1	5 bit change
16	1	0	0	0	0	

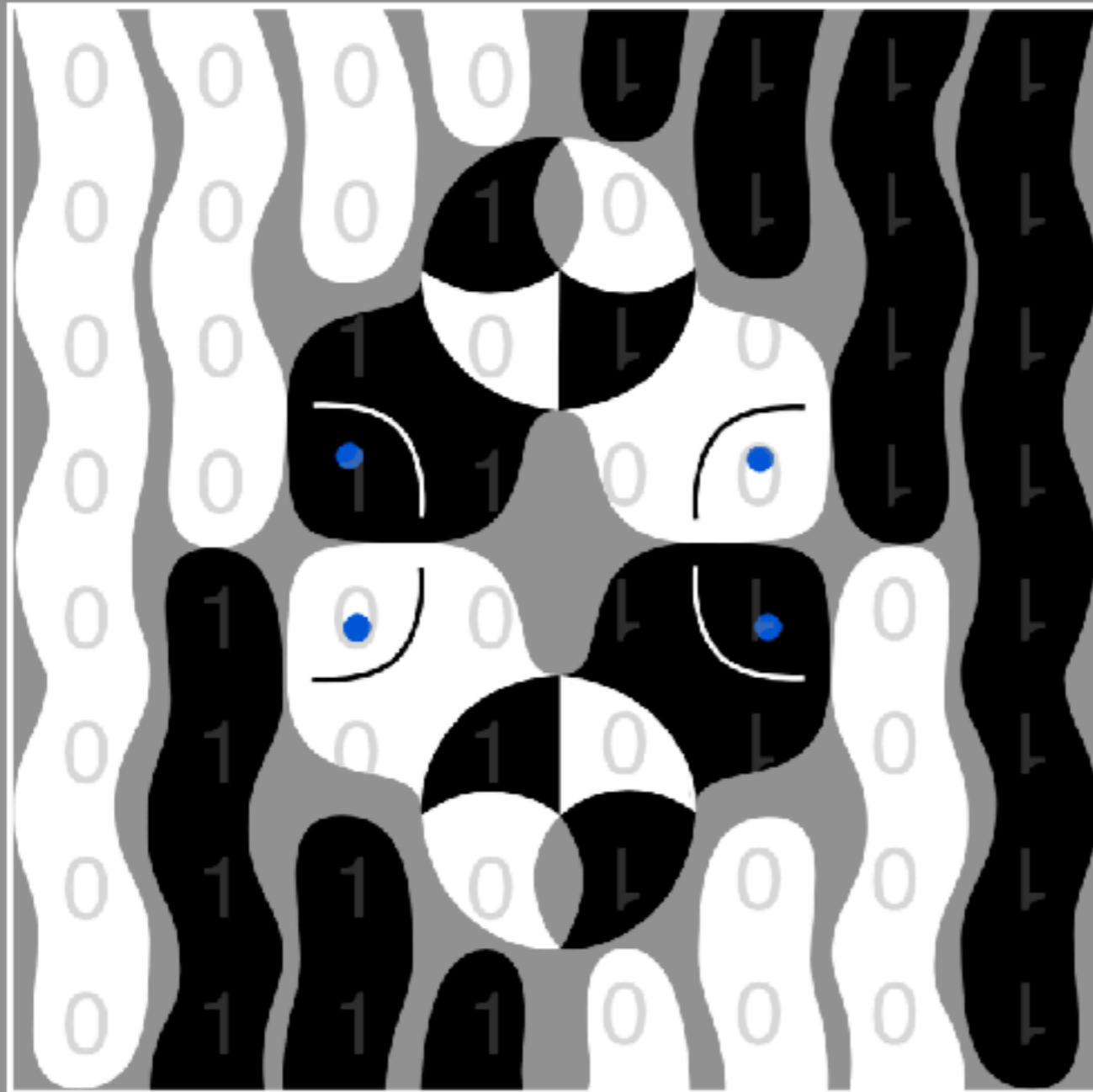
0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

0	0	0	0
0	0	0	
0	0		0
0	0		
0		0	0
0		0	
0			0
0			
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	0	0	
	0		0
	0		
		0	0
		0	
			0



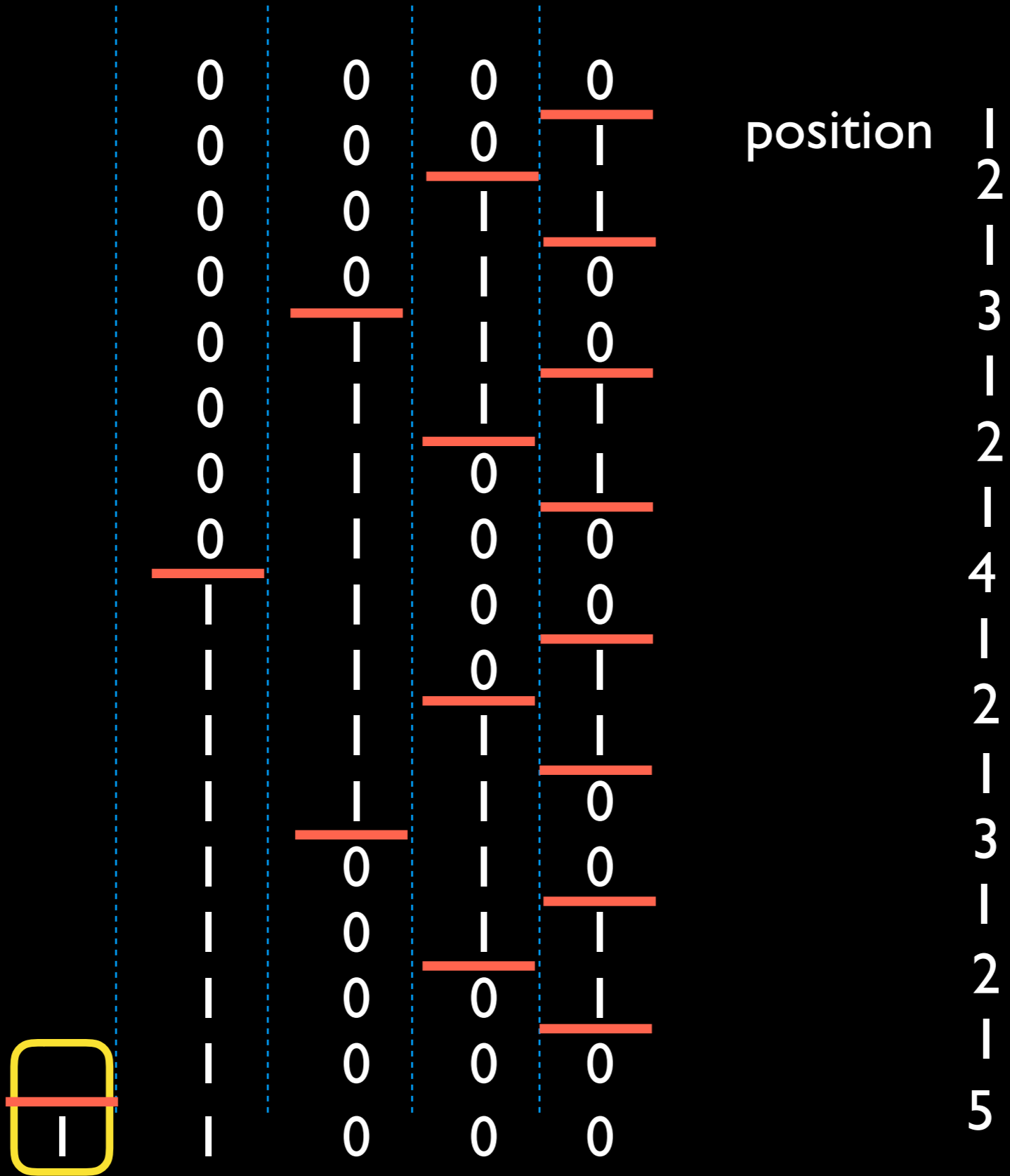
0	0	0	0						
0	0	0		0					
0	0		0		0				
0	0			0	0				
0		0	0				0		
0		0		0			0		
0			0		0	0			
0				0	0	0			
	0	0	0						0
	0	0		0					0
	0		0		0				0
	0			0	0				0
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				0	0	0	0		



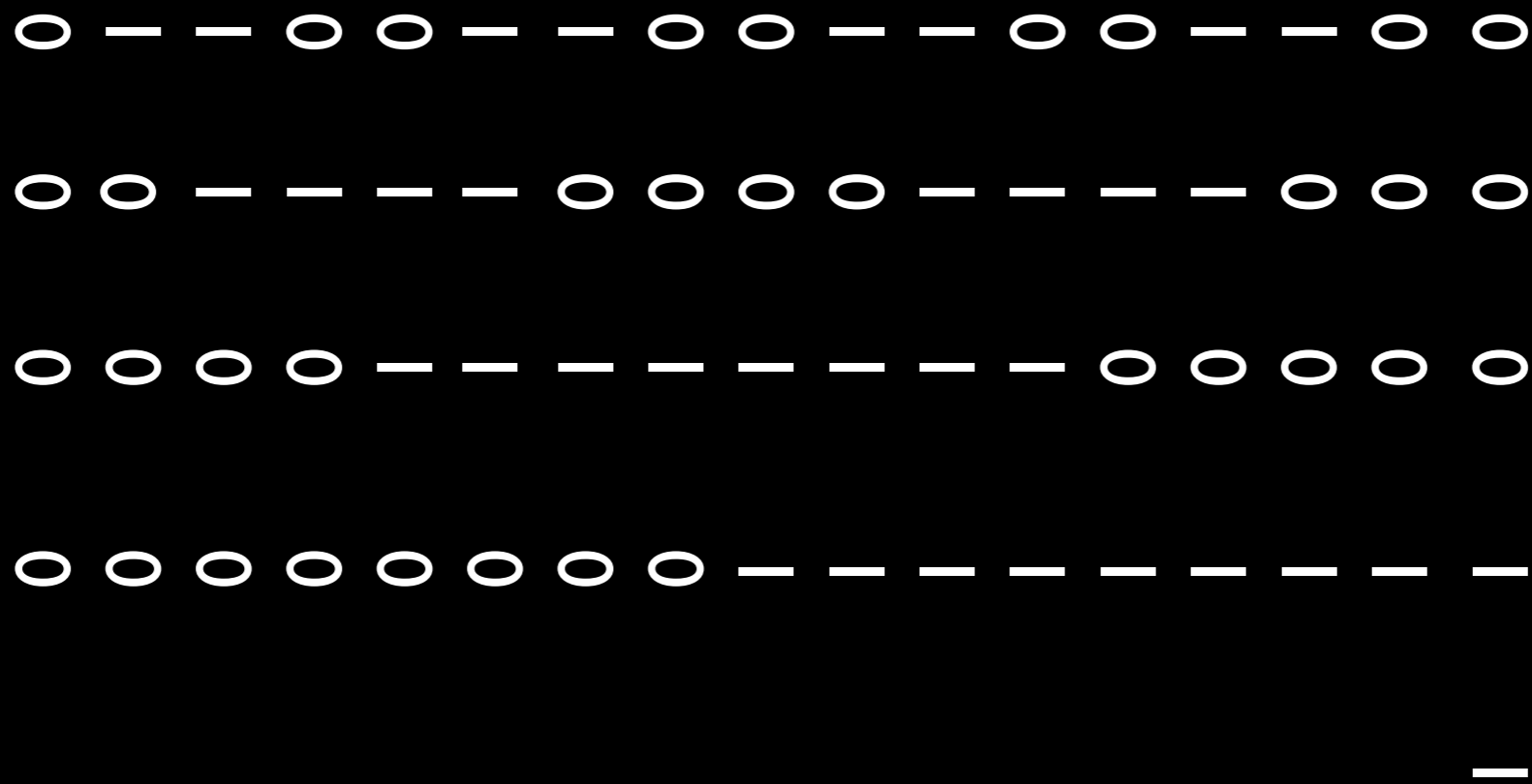


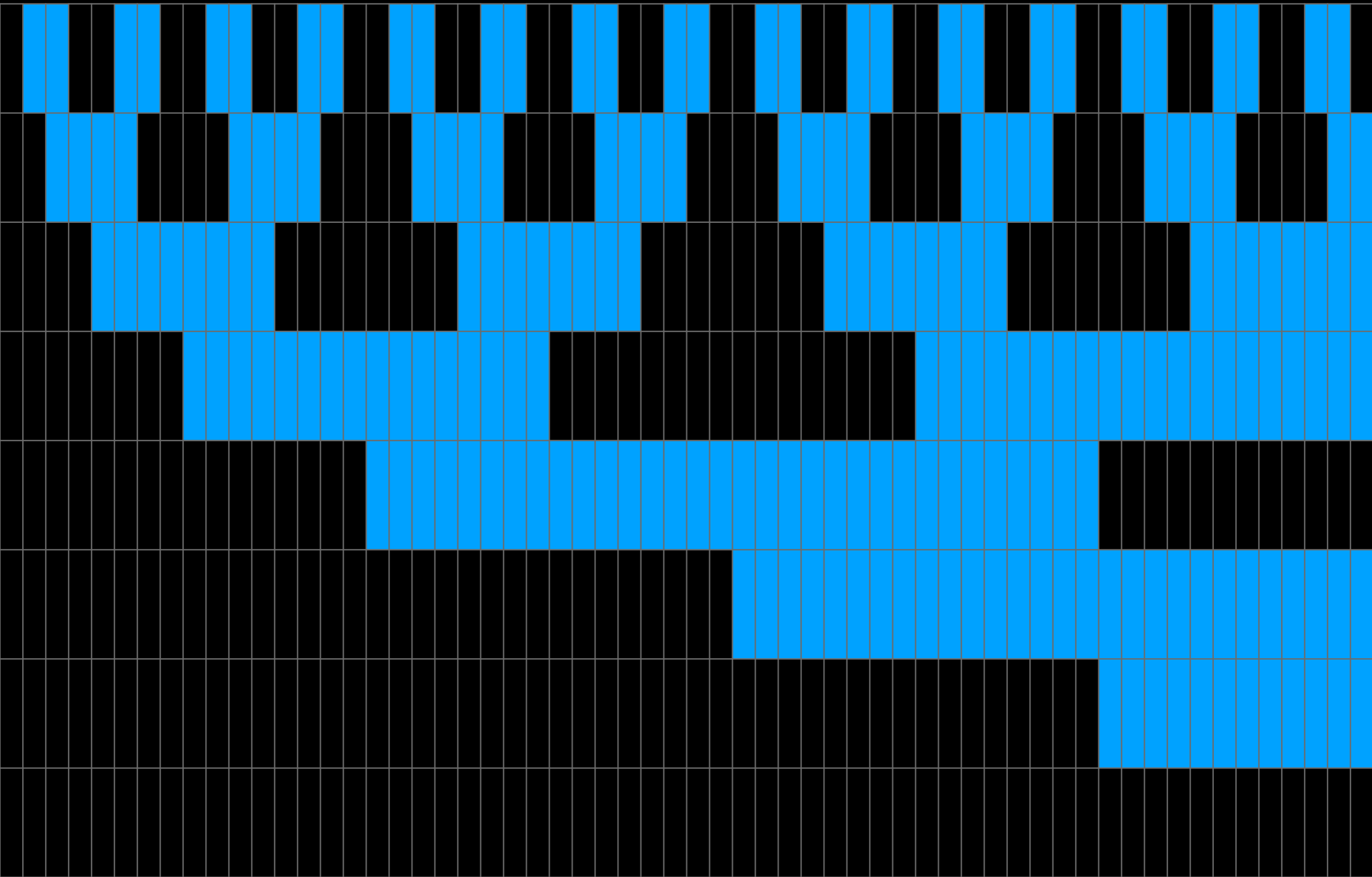
Misses
MikeNaylor

Gray Code



Gray Code





00000000

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00000011

00000010

00000110

00000111

00000101

00000100

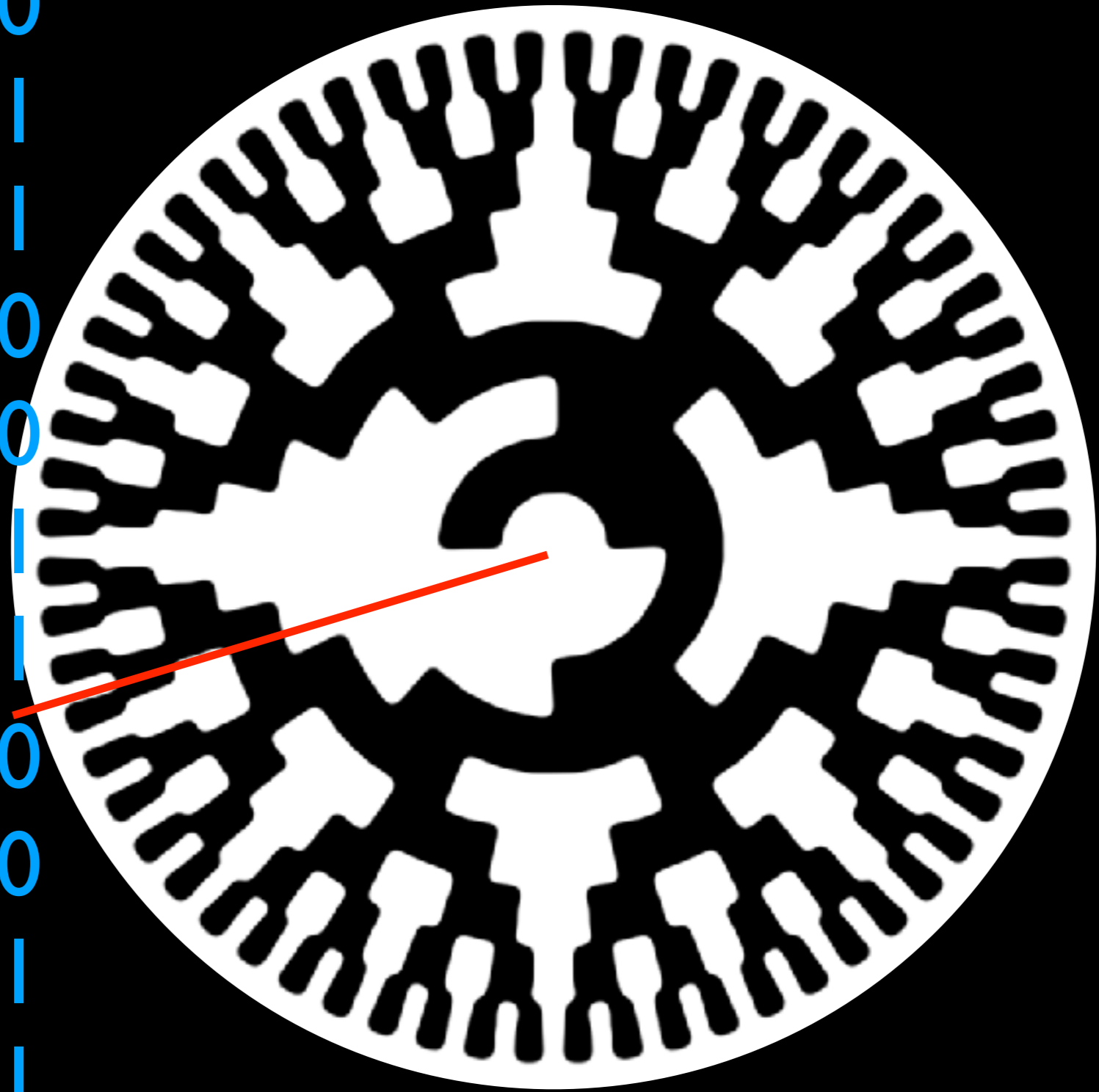
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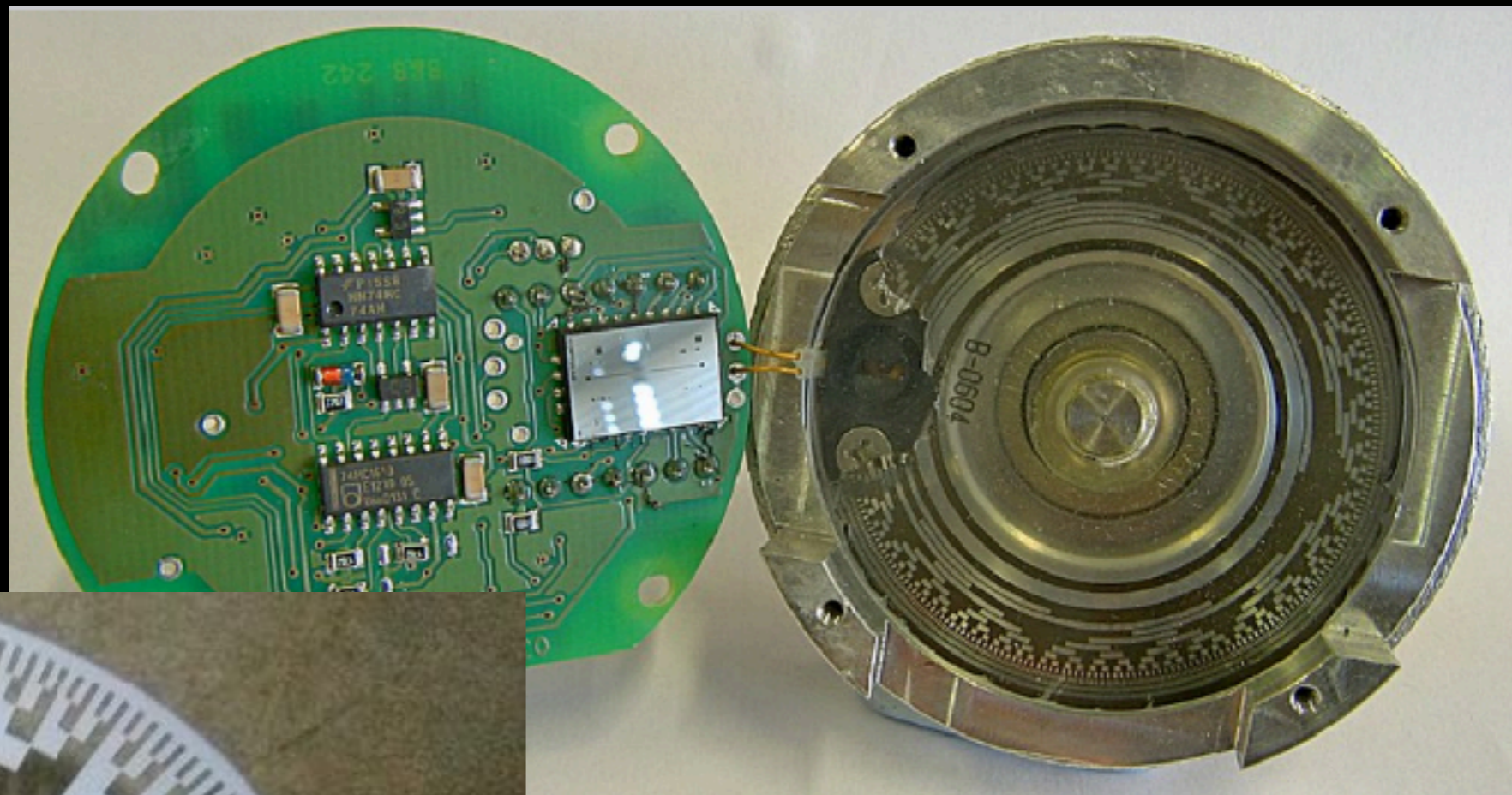
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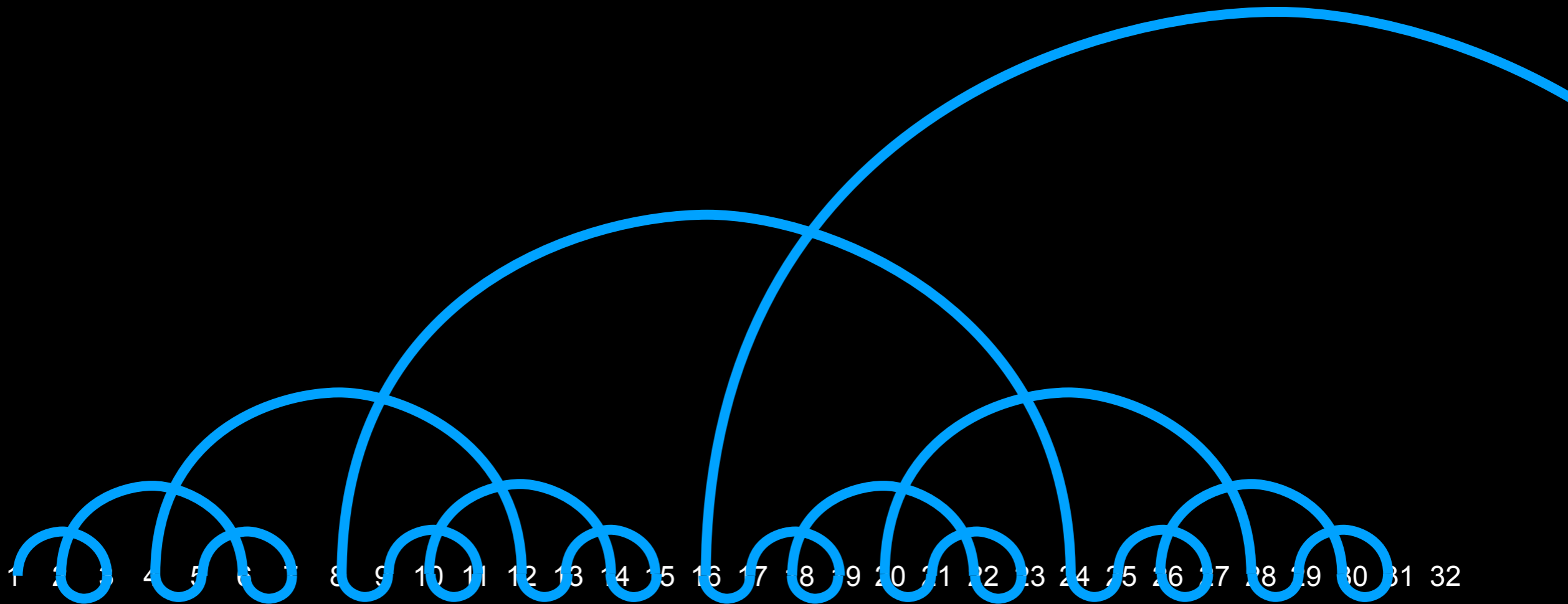
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00001010



Rotary encoder position detectors



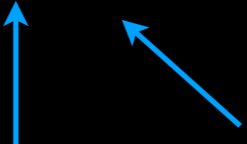


0, 1, 3, 2, 6, 7, 5, 4, 12, 13, 15, 14, 10, 11, 9, 8, 24, 25, 27, 26, 30, 21, 29, 28, 20, 21, 23, 22, 18, 19, 17, 16, 48, ...

A B A C A B A D A B A C A B A

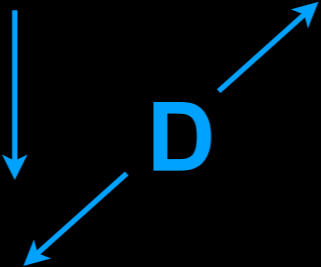


1d line segment

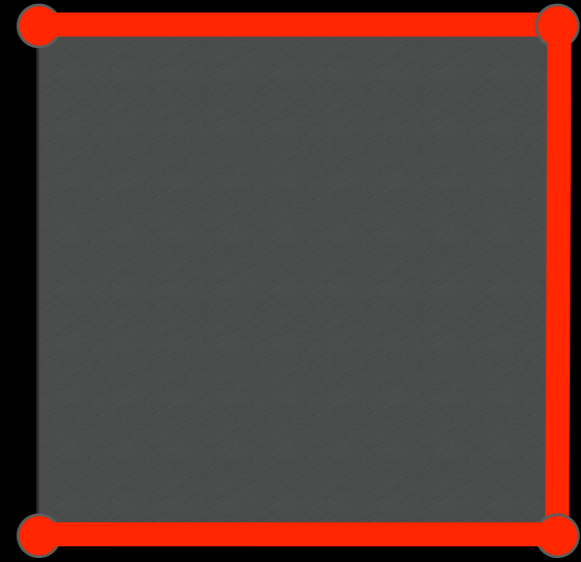


B

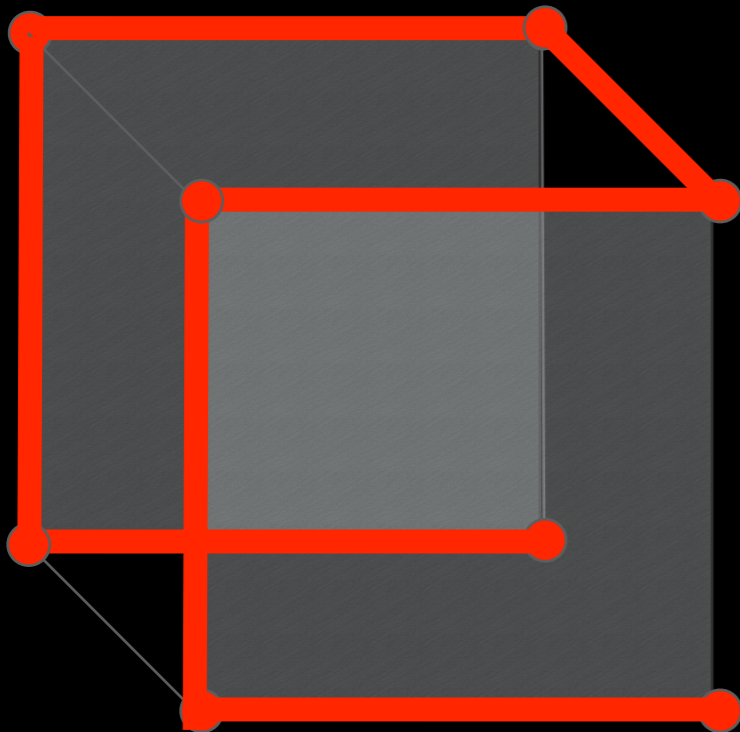
C



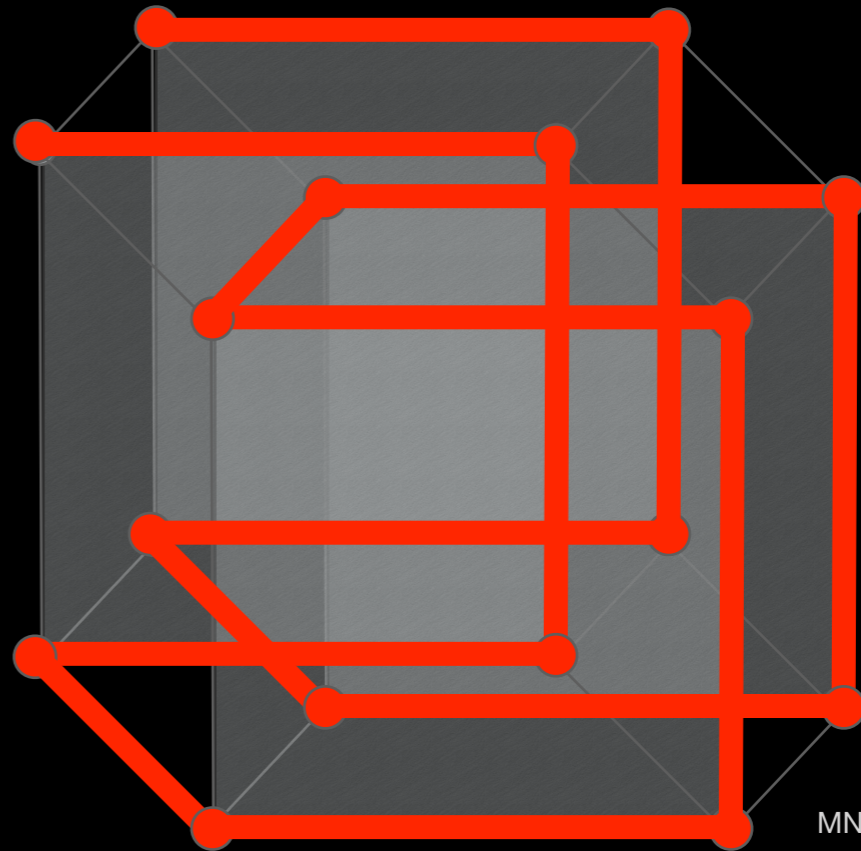
D



2d square

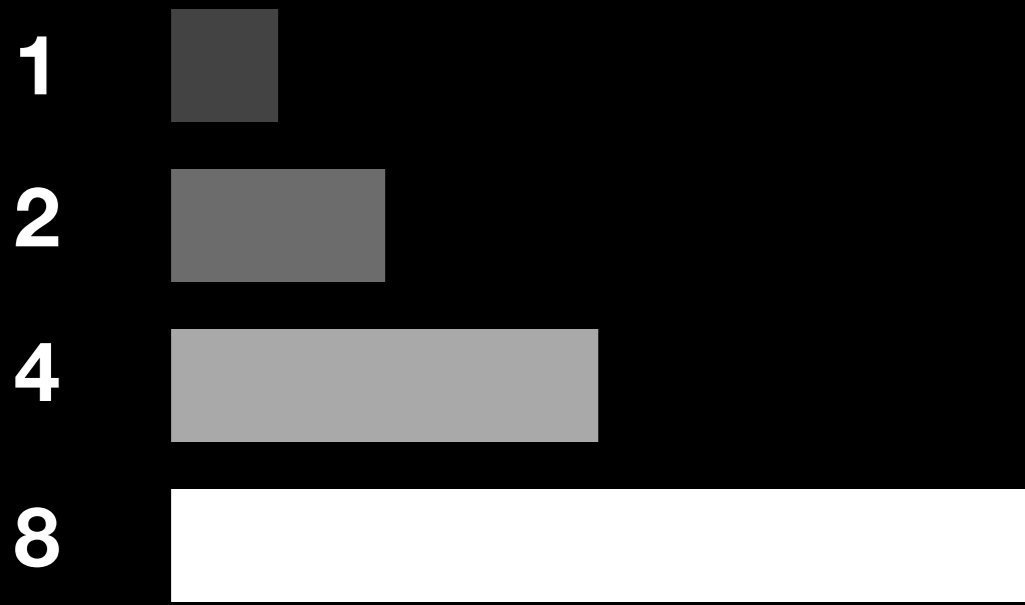


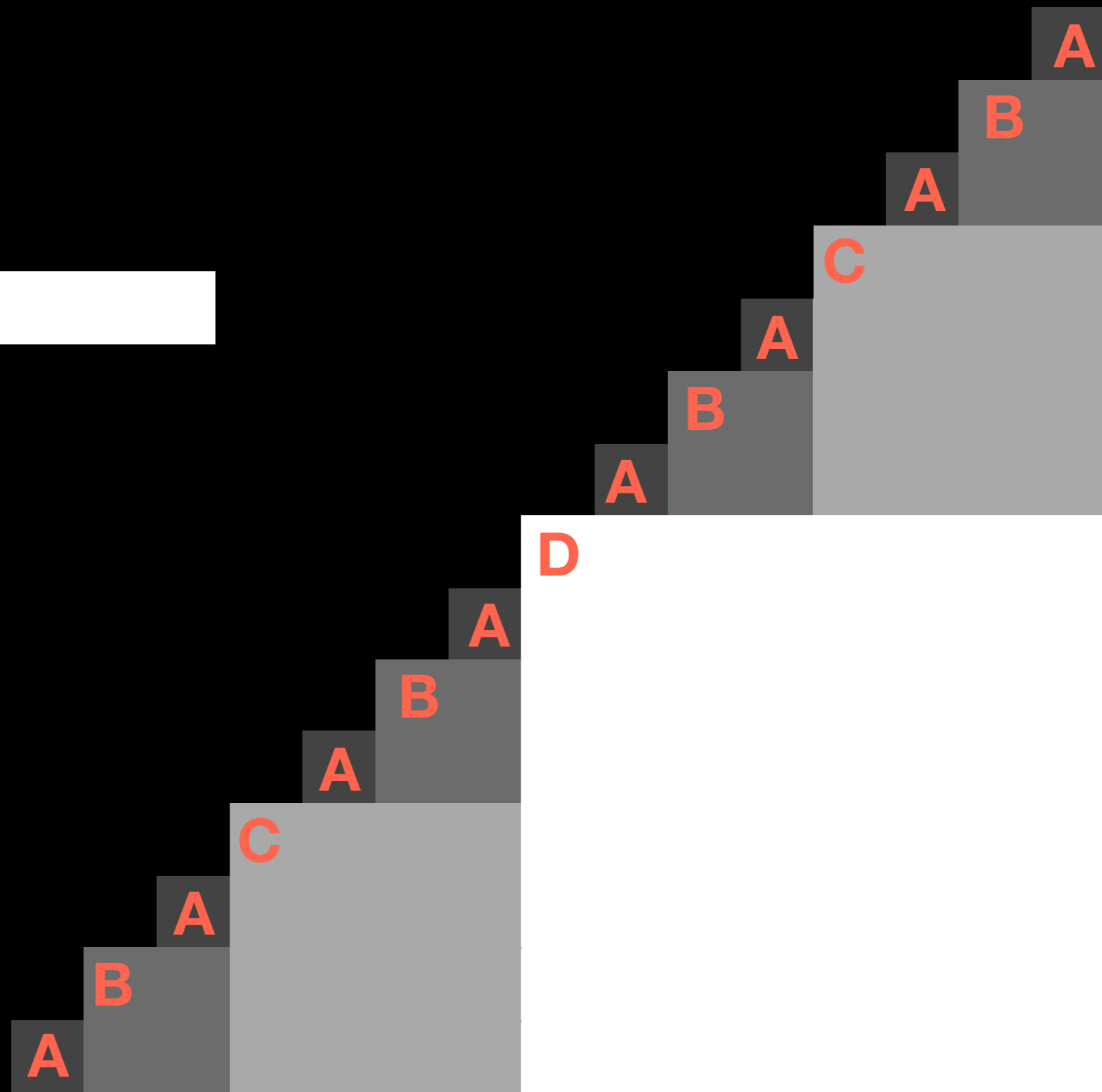
3d cube

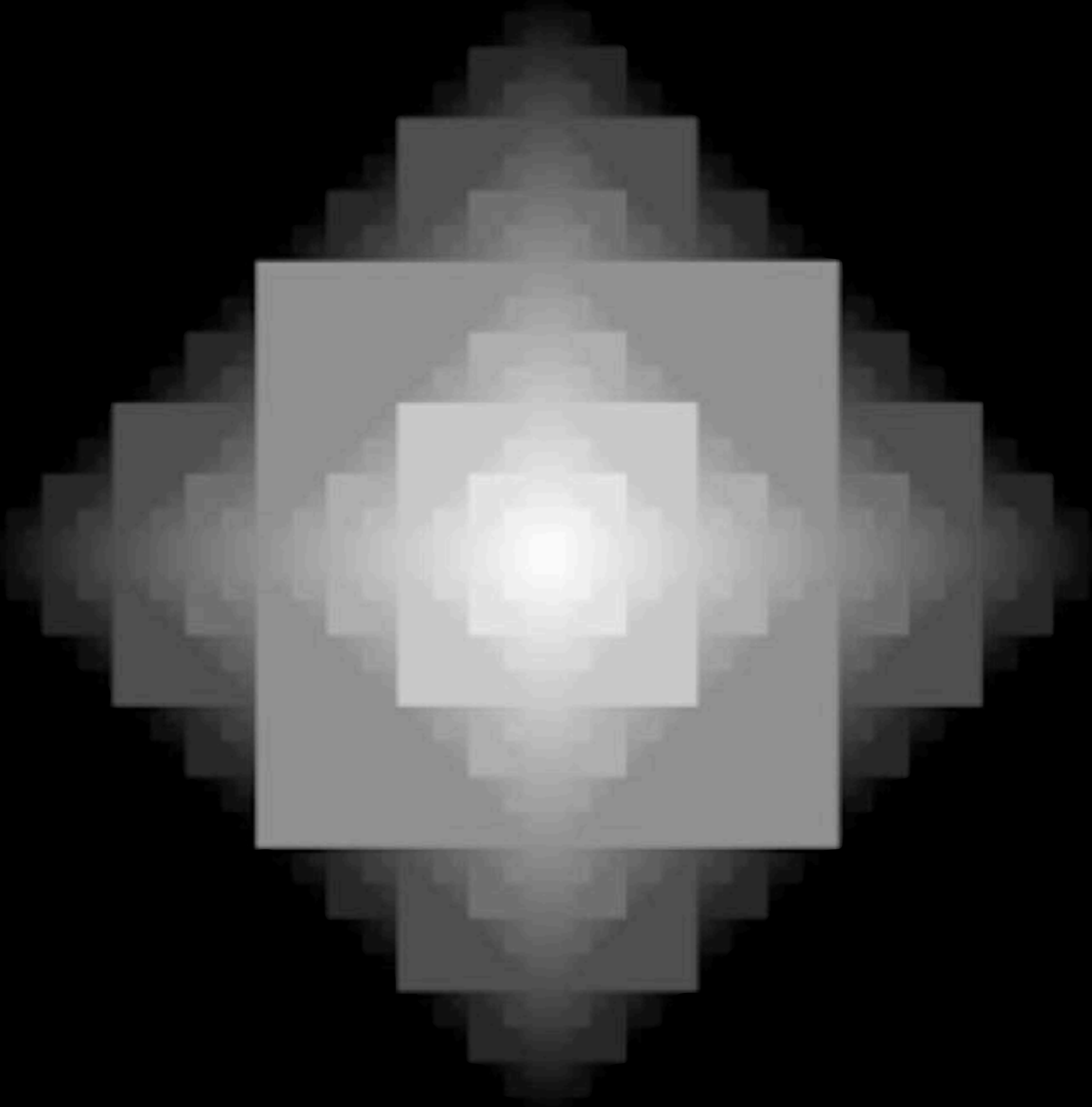


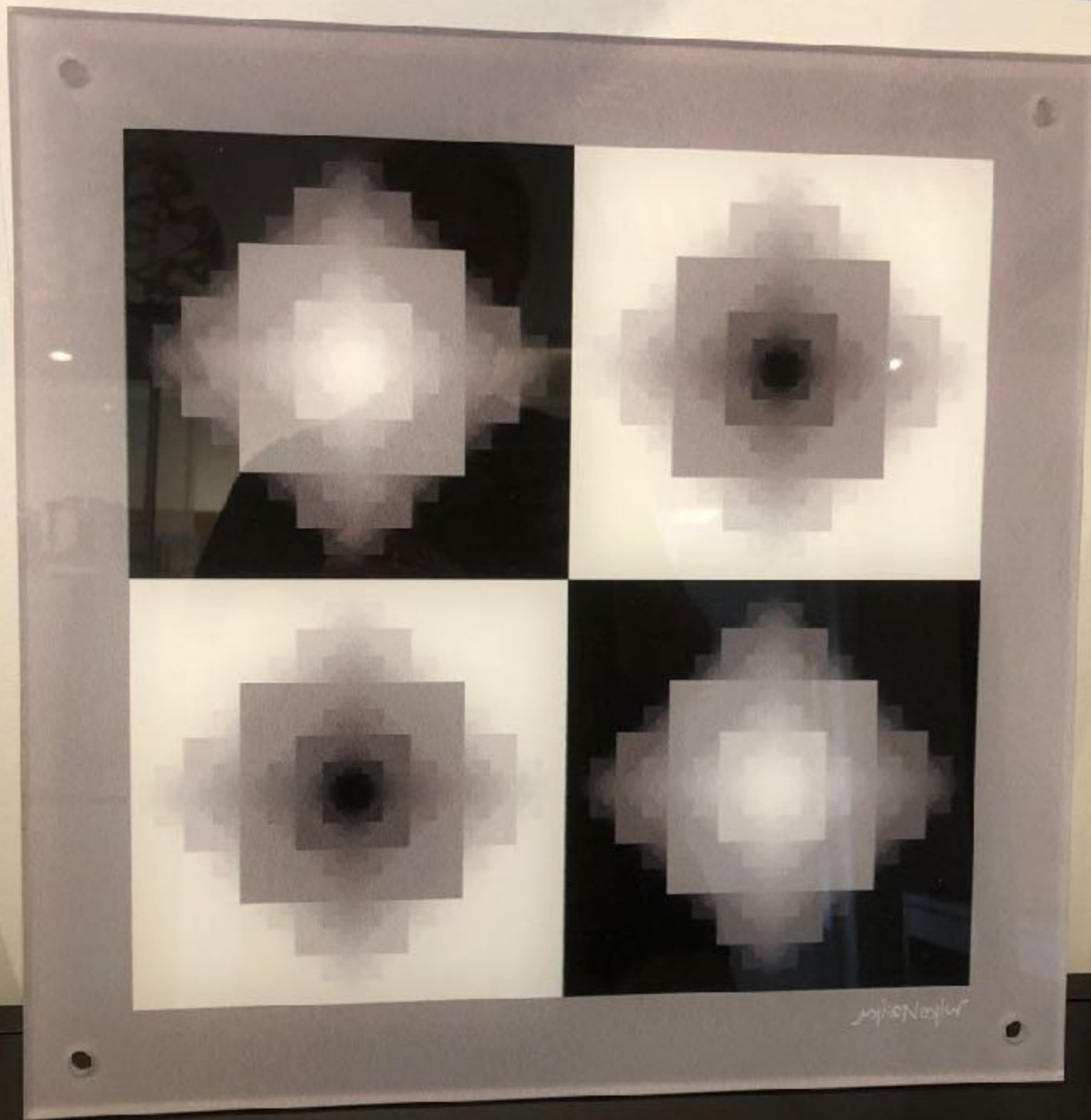
4d hypercube

MN

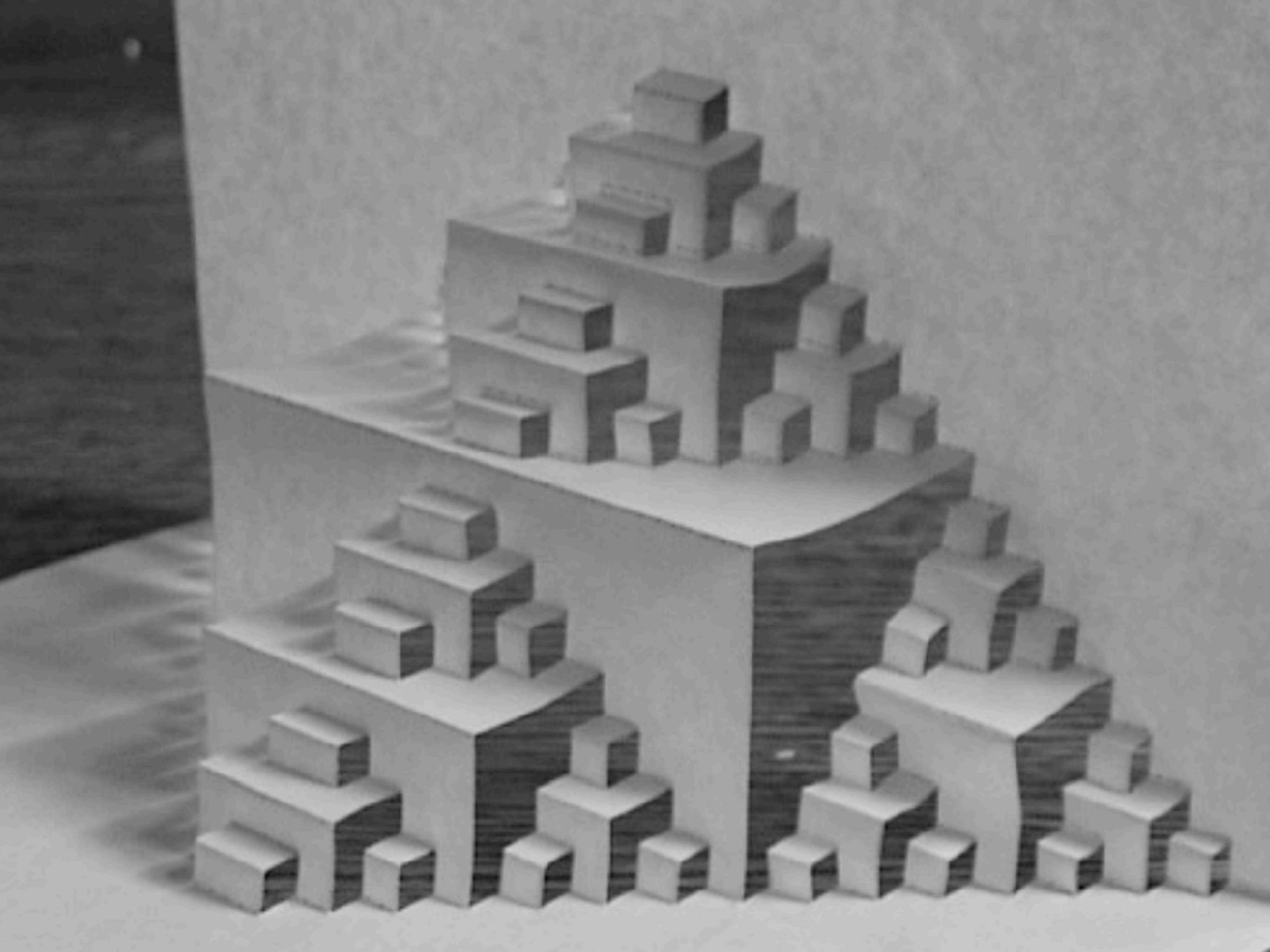


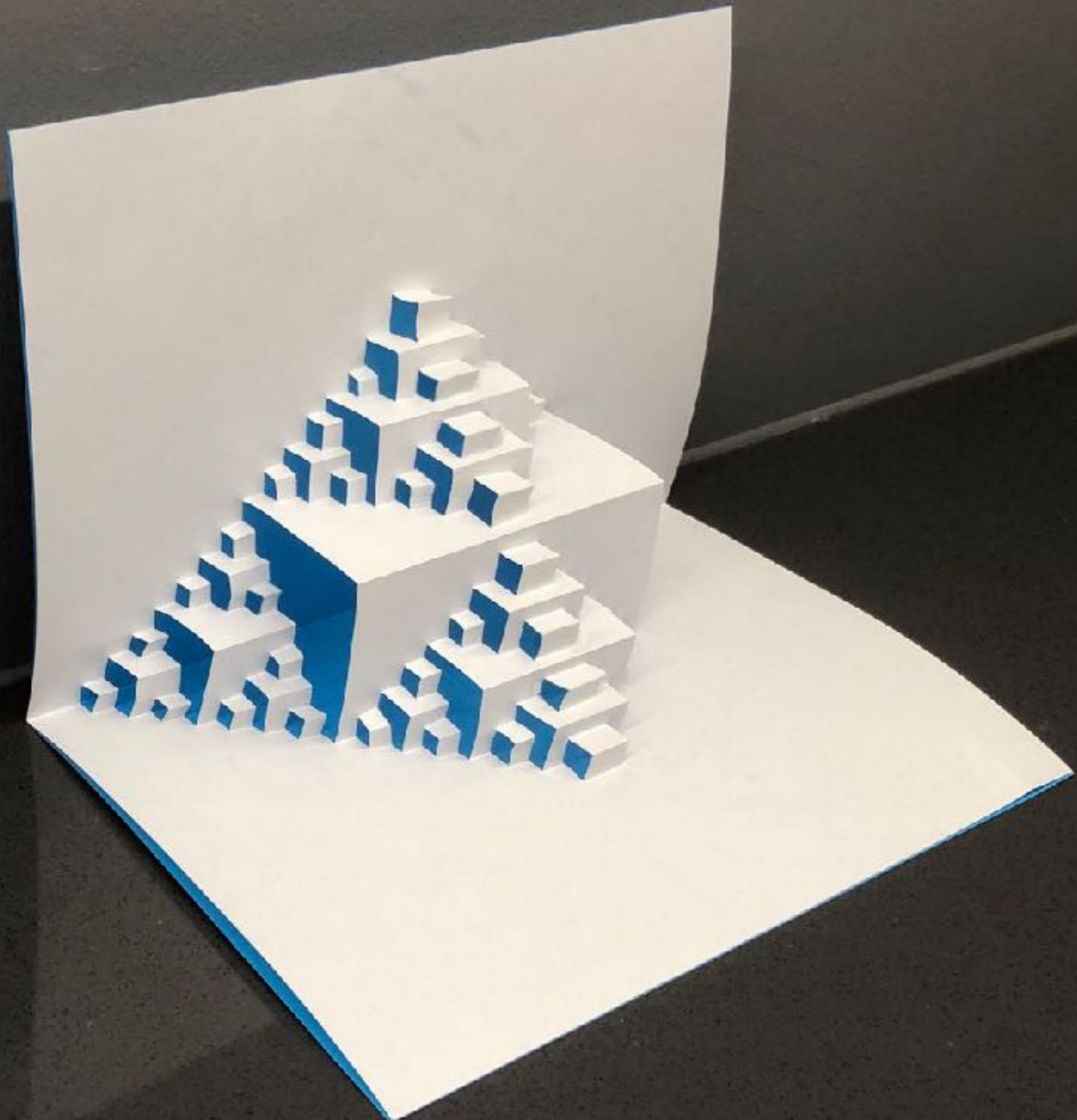






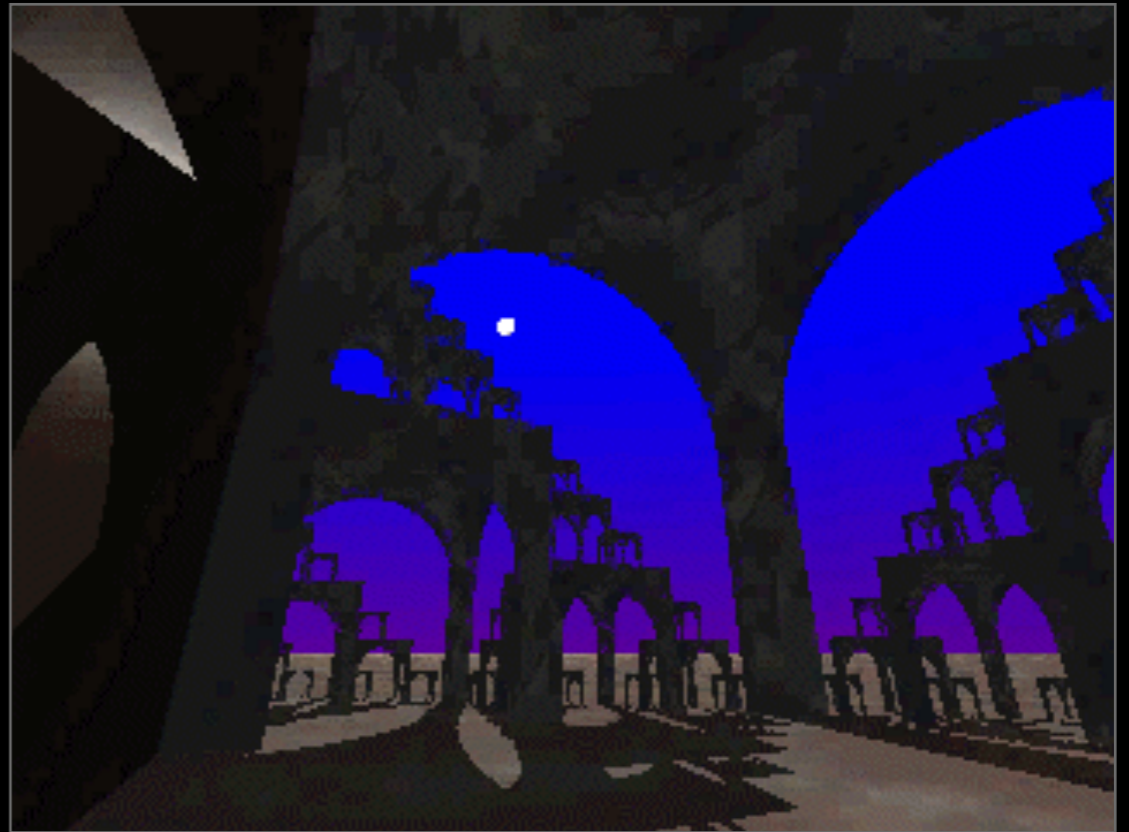
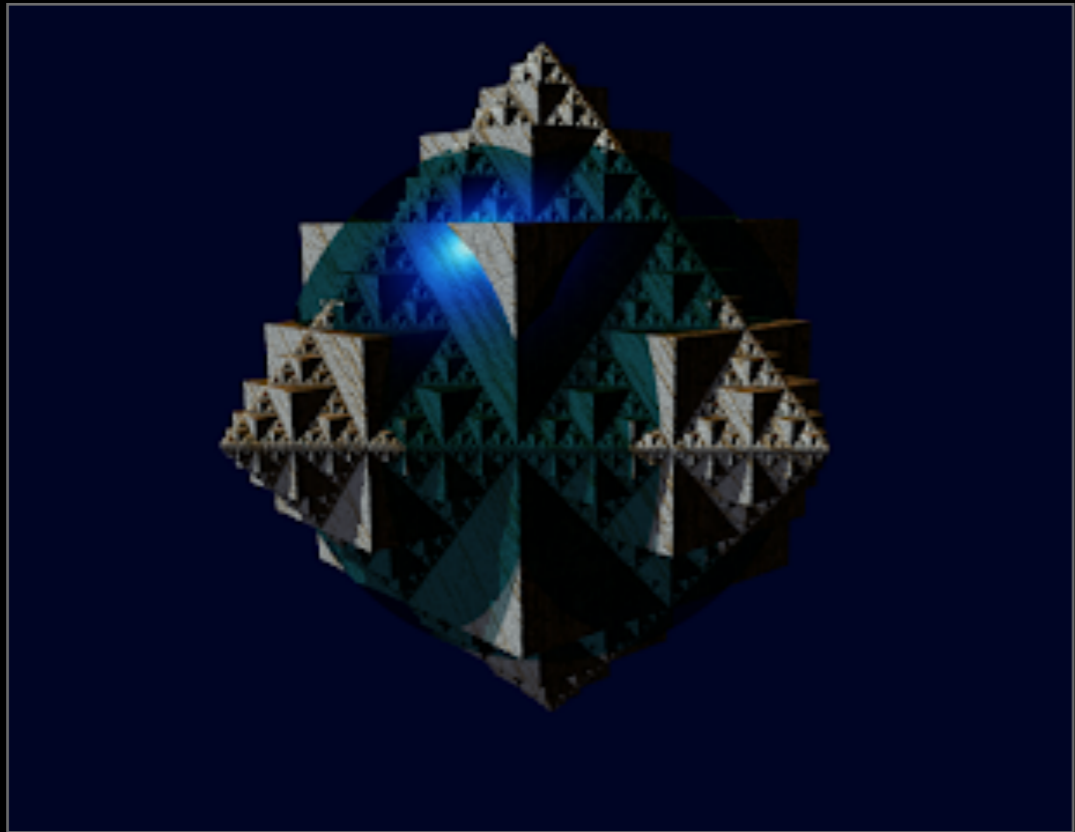
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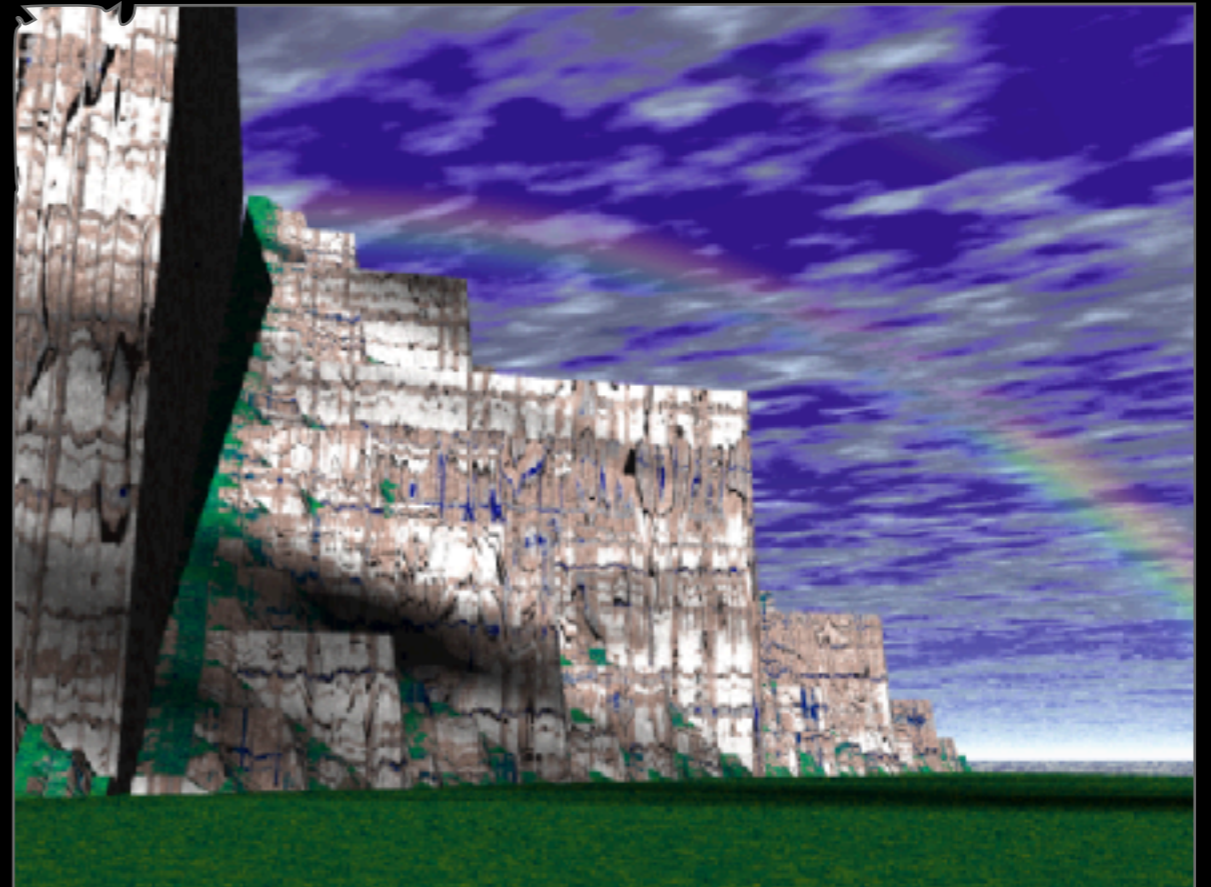
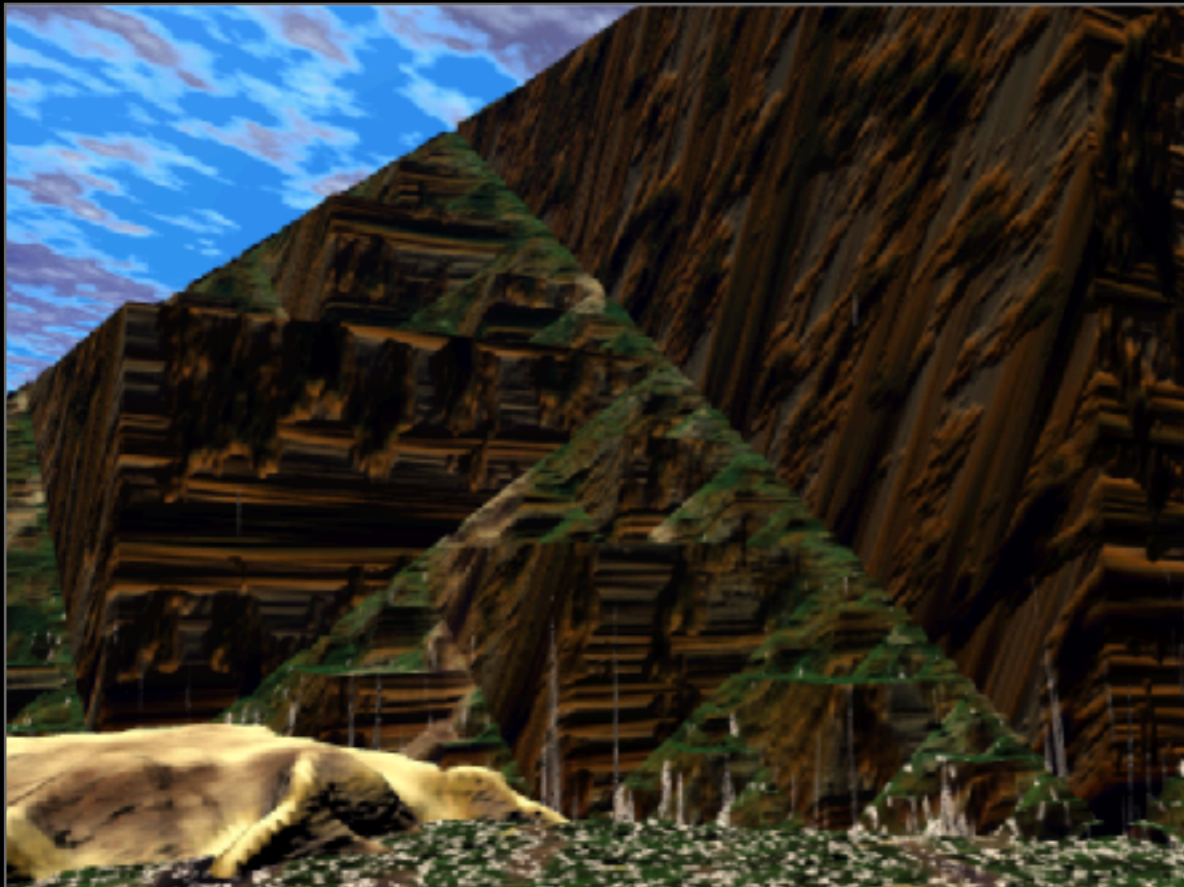
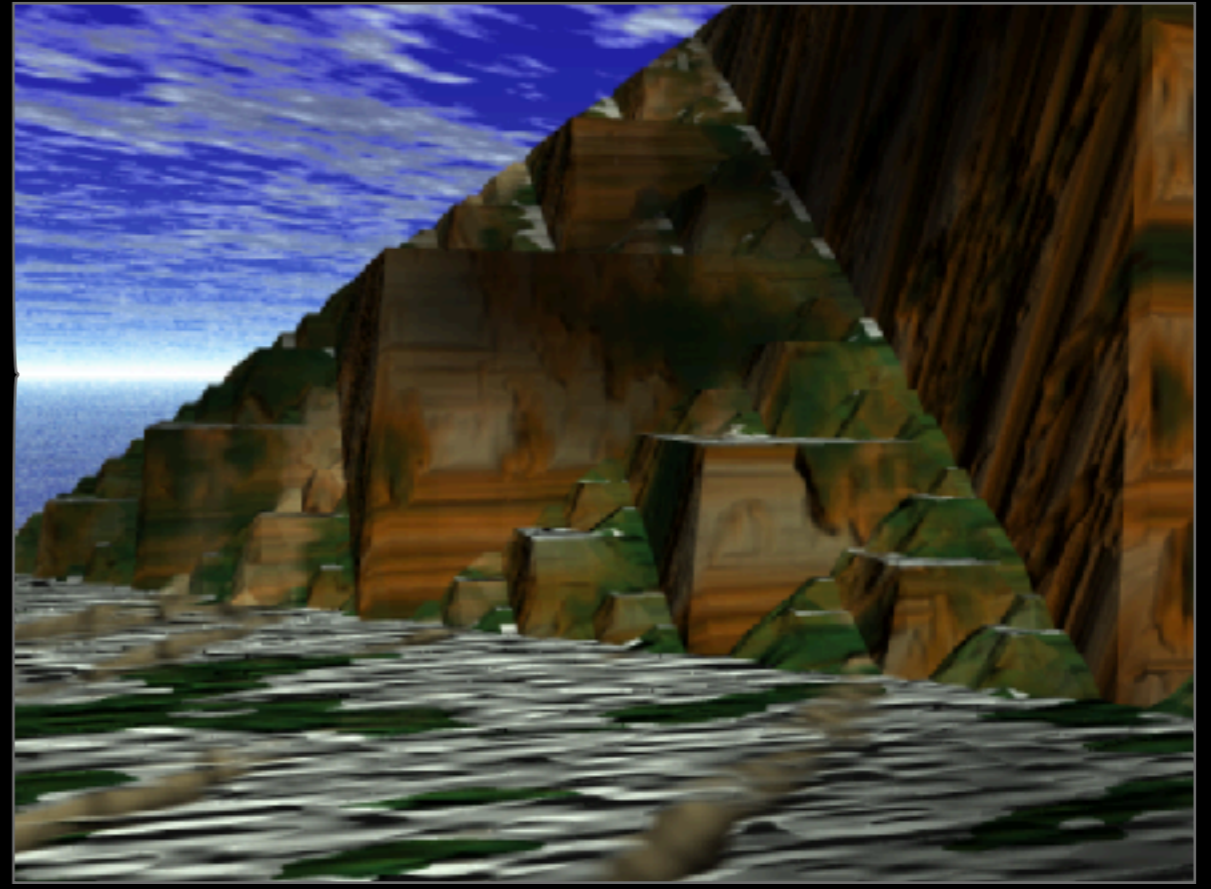














AbacabaX

Max must awaken the powers even he assumes he has, before he breaks the world.

Max Teller is on the run for his life on Abacax, a world of incredible patterns, danger and beauty. He stands on the brink of destruction. Four families with unique abilities, are locked in a struggle for power and revenge while dark creatures have a deadly purpose. Max is lost and alone, not knowing whom to trust and unable to awaken the powers that everyone thinks he has. Armed with a broken abacus and his unconventional imagination, he must make unlikely allies and face the growing awareness that he may be the one destined to destroy it all.



Mike Naylor is an international award-winning artist, author, poet, inventor and cofounder of the Mathematics Creativity Center in San Francisco. For the past billion seconds he has been popularizing the wildest ideas from the world of mathematics, many of which have found their way into this novel.



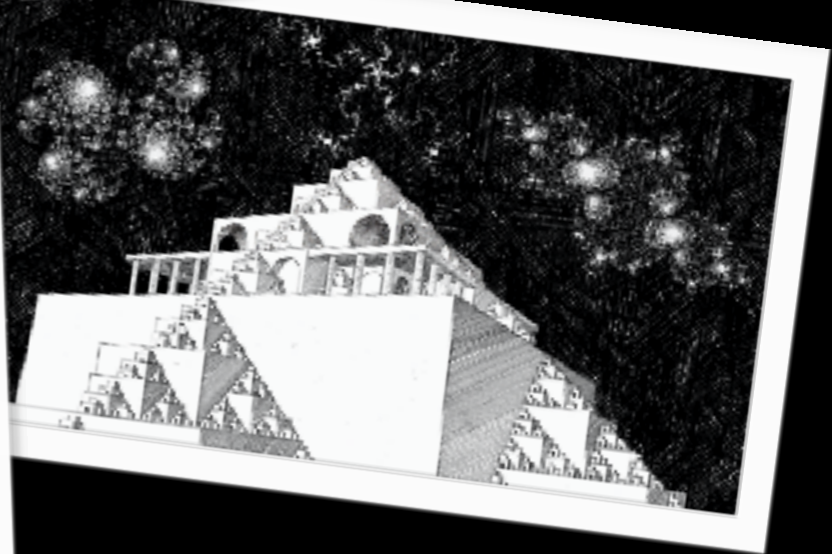
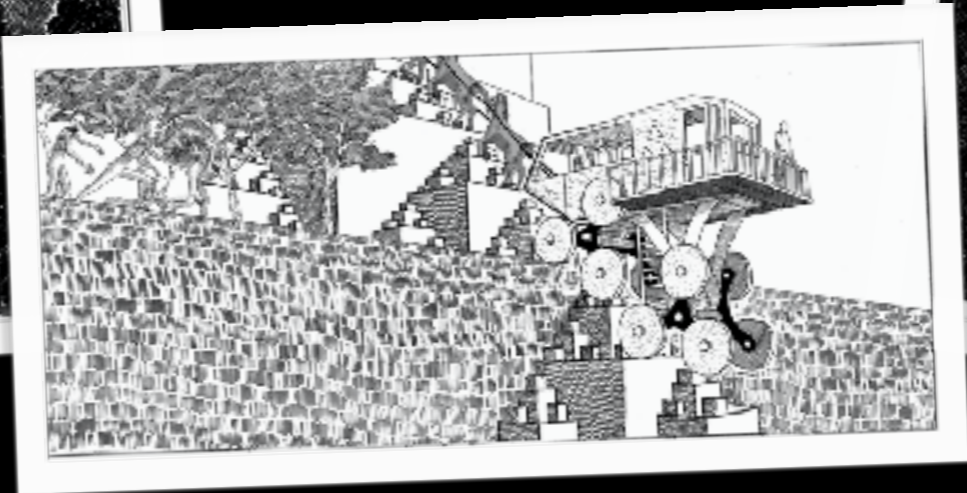
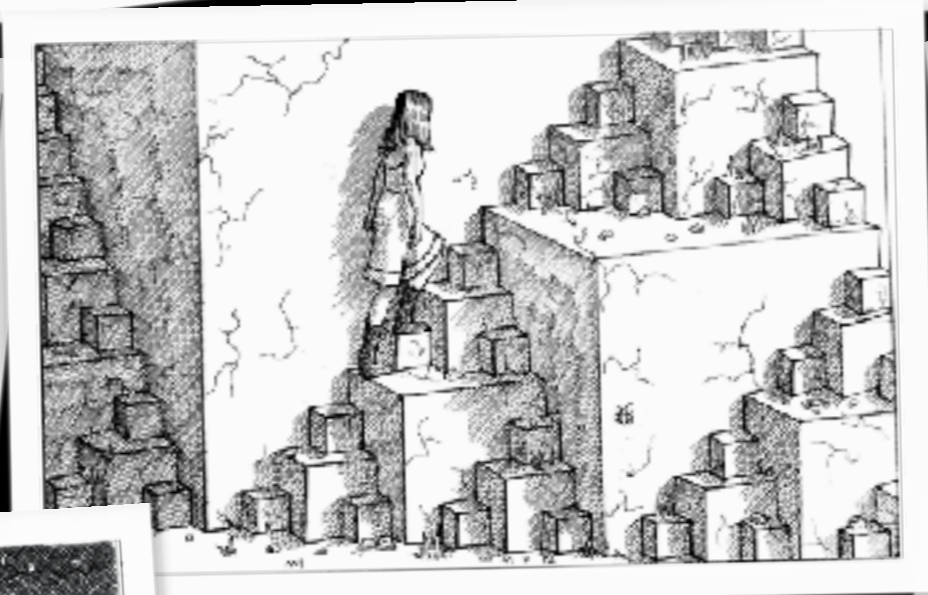
1 234567

ABACABAX

Mike Naylor



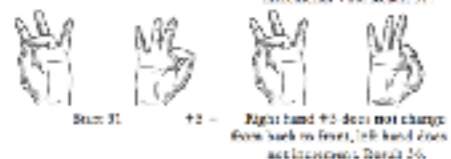
Mike Naylor



Incrementing 10s when adding

Any time doing an addition when the thumb travels from the back (finger) side of the fingers to the front (palm) side of the fingers (from a number 50 to a number 60), the left hand adds +10. This will become automatic with practice.

For example, here are two hands showing 20. When 5 is added, the thumb travels from the back of the first finger to the front of the first finger (a change of 5), and then left hand increments from 20 to 30. The result is 25.



Another example: $28 + 28$. From the start position 20, first add 20 on the left hand. Next, add 8 on the right hand, by subtracting 2 on the right and adding 10 on the left. The result is 57.



Notes from the first family: A short guide to finger reckoning

Finger reckoning is very quick and easy for adding and subtracting numbers from 0-99. The system is built on connections between 50 and 100, and two different ways to add or subtract digits depending on the digit relationships to 50 and 100.

Basic principles

The right hand is used for tens, from 0-9, and the left hand is used for ones, from 0-9. One is an open, empty hand. The numbers 1-4 are made by touching the thumb first against the pad of the first, second, third or fourth finger.



Five is a closed fist. The numbers 6-9 are made by touching the thumb against the fingers of the base, first, second, third or fourth finger.



The left hand uses these same positions to count tens.



70 = 7 on the left hand (70) and 5 on the right hand

Notes from the second family: A short guide to bone showing

Bone Thirteen are numbers represented as powers of two. This makes operations quite and simple, though the awkwardness of the number system can make using up the available digits challenging. Bone thirteen calculation with ten conceptual bones from a pair of human hands. If hand bones are not readily available in your area, you may substitute small toys or manipulatives.



Basic principles

Bones are placed in a line. The line may be as long as the number of bones available for use, usually ten, though we will use fewer in many of the examples here. Bones can be placed "standing up" in a horizontal position or "standing up" in a vertical position. (Bones that are "standing up" are not literally standing and balancing on one end, they are simply meant as they are in a different direction.) Any bone lying down has a value of one. The basic starting position is with all bones lying down and showing paths of zero.



When a bone is turned so it is standing (in a vertical position), it has a value according to its position. The bone furthest to the right has a value of 1 when used in the vertical position. The second bone from the right assumes a value of 2, the third has a value of 4, the fourth a value of 8, and so on. The value doubles from one position to the next.

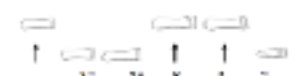
The following diagram shows the number 21 with six bones. The standing bones have values 16, 4 and 1, and together their sum is 21.



With these six bones, all numbers from 0 to 63 may be formed, each in a unique arrangement. With ten bones, the total number of unique numbers can be created up to 1023.

A second way to represent a number

Instead of standing or falling down bones, numbers are also represented by raising or lowering bones. Here, for example, is the number 26 made by raising the bones in the 32, 4 and 2 positions: $32 + 4 + 2 = 38$.



Both methods of representing numbers can be used in the same time to show different numbers on one set of bones. This is useful for operations when the two numbers to be operated on can be set up simultaneously. In the following illustration, the standing bones represent 21, and the raised bones represent 38.



Addition

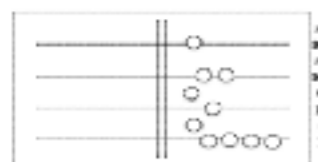
Adding numbers is accomplished by setting up the numbers to be added and then sliding down the raised bones, turning them as they are moved. The same rule as one can be followed by using additional sums of bones, depending on whether the raised bones stand up or fall down when lowered. Here are two simple examples.

Notes from the third family: A short guide to calculating on the abacus

To "calculate" literally means to reckon with stones. Calculators are small rounded stones called "chips" or some stones called "abacus" or square calculations efficiently.

Stones are used to do calculations on the left forearm, held with the left hand gripping the right edge and stones resting securely against the user's elbow and body. Calculations have large patterns down over the left breast of the user's wrist held loosely there, making it easy to take out or return stones as needed.

A standard abacus has four lines curved horizontally and a double line curved vertically dividing the board in two. Numbers are created by placing stones on or between the horizontal lines. Stones on the lower line have a value of 1. Lines above increase in value 10 times, so the other lines have values 10, 100 and 1000. Stones are also placed between the lines to have values 5 times that of the line below, or 5, 50, 500 and 5000 at the very top.



In the picture above, the number on the right side of the board is $350 = 3 \times 100 + 5 \times 50 + 1 \times 1 + 4 \times 1$. (Note stones are usually not marked with numbers. Line values are related to those. It is easier for clarity.)

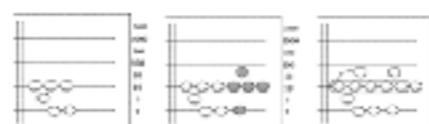
Lines (or spaces between lines) may contain as many stones as there is room for, and when a stone is placed on a line it is not important for addition or subtraction. Counts of stones are made throughout calculations and at the end of the calculation, so the 5 stones on the 10 line for example can be moved for 1 stone on the 50 line, 5 stones on the 500 line can be moved for 1 stone on the 1000 line, and so on.

When referring to a value "on a line," a stone is the space above the line is considered part of this value. In the above illustration, we would say that the bottom line holds a value of 5, even though one of the stones is not directly "on" that line.

Addition

Nothing could be easier than Chinese addition. Simply place stones on the board to represent the first number, place additional stones on the same lines to represent the second number, and then make appropriate exchanges to minimize the number of stones needed to represent the result. (Digits are sometimes built each number on the two sides of the board and then slide them together, but this can step is generally not needed.)

Example with 37 + 81



37 + 81 = 118

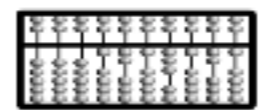


98 + 101 = 199

Notes from the fourth family: A short guide to the abacus

The abacus is an elegant and powerful tool developed directly from the abacus and uses many of the same principles. Instead of placing and moving stones, an abacus uses columns of beads that slide up and down on rods, allowing for extremely quick calculations and very large numbers. Perhaps, the abacus offers the convenience of a simple device with moving parts of held together in a single frame that fits easily in a pocket.

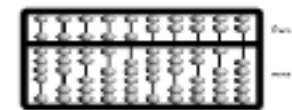
The columns of beads are called "rods" and they are divided in two sections by a middle bar. The top section has two beads that have a value of 5, and the bottom section has two beads with a value of 1. Some abacuses have 1 and 5 beads, and some have 1 and 2, but we will use an abacus with 5 and 5 which can be easier to learn.



The rods represent increasing powers of 10 from the right, so numbers can be set up as we are accustomed to using. The number of beads can vary, we will use an abacus with 10 rods. We use 10 rods to represent and represent billions, though for some operations different ones of the beads are used to place two or three smaller numbers on at a time. (Most abacuses use an abacus with 12 rods, although some abacuses, like the Four Tablets, have as many as 14 to 20 rods.)

The abacus is cleared by sliding all the beads on the top section, and all white beads on the bottom downwards. Right are cleared by sliding beads towards the middle bar. This is done with a sliding motion so the 1 beads and 5 beads are moved simultaneously.

The two different digits are shown below.



Addition on the abacus is quick and easy. To be able to add easily, you must learn two different moves for each digit. The following sections detail how to add each of the digits. If you practice with each of these digits as described below, adding numbers of any size can be done very easily and almost automatically.

Part 1: Adding 1 and sliding 5

Digits with an empty abacus. Add 1 to the first rod (the rod on the right) by sliding one bead upwards with your right thumb. Continue adding one until all 5 beads are up.

When all five beads in the lower portion of the abacus are up, they should be immediately traded for a five bead. Place your index finger on one 5-bead and your thumb on the top 1-bead and move both beads in the same direction. These should now be just one 5 bead at the middle bar. Trades are always done by moving in the same direction.



Counting 0 to 5, with a trade

Notice that when adding 1 to a rod that is showing a 5 bead, it is not necessary to raise one bead and then lower all five. This same trade can be eliminated by instead by sliding the four beads back downwards and sliding down a 5 bead in the same time. Performing a -4 and +5 at the same time gives the result +1.

How to make a tree with a trunk and branches. The trunk is made of a 100% scale of wood. The branches are made of a 100% scale of wood. The trunk is made of a 100% scale of wood. The branches are made of a 100% scale of wood. The trunk is made of a 100% scale of wood. The branches are made of a 100% scale of wood.



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Use some color with paint or coloring program to give your tree a natural look.

5. Make a model from building blocks

Try building a 3d model of a fractal tree from building blocks. You can use Lego bricks, wooden blocks, clay, etc. to make the trunk and branches. The trunk is made of a 100% scale of wood. The branches are made of a 100% scale of wood.



Alternative tree - Lego



3 model from wooden blocks

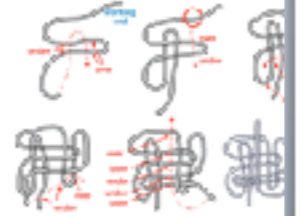
6. Tie a quipu



Try making a quipu, which is used as a simple calculation device with long knots in special positions. Make a quipu with knots in an Fibonacci pattern. You can use three long loops (one red, one blue, one yellow).



10 knots



6. Complete knot

3. Pop-up model I: Abacus-staircase

Print out the pop-up staircase template from www.cutoutsonline.com

1. Fold the paper in half so the printed side is on the outside.

2. Cut from the left along the marked line so the paper folds up on the right side, and fold back down again.

3. Open the paper and glue the sides together. The staircase will be made of paper and will stand 2 feet tall. Fold both sides up again, and fold back down. The staircase will stand 4 feet tall.

4. Repeat the steps on the next section as shown. You will cut through 3 layers of paper and create 6 feet of staircase. The staircase will be made of paper and will stand 6 feet tall.

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2. Tetragrams

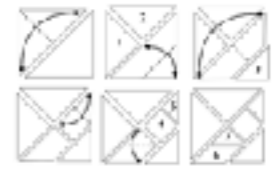
The Abacus staircase is made of a beautiful city-like structure. The staircase is made of a beautiful city-like structure. The staircase is made of a beautiful city-like structure.



A staircase is made of 7 blocks. The staircase is made of 7 blocks. The staircase is made of 7 blocks. The staircase is made of 7 blocks.



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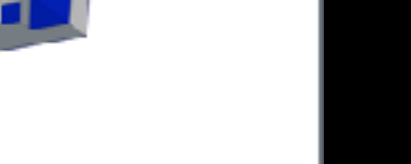
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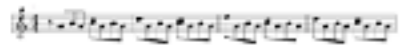


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3. The Music of Abacax

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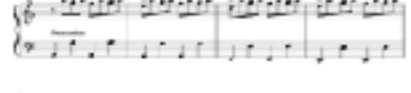
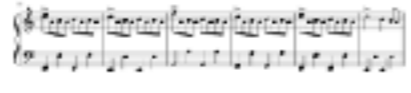
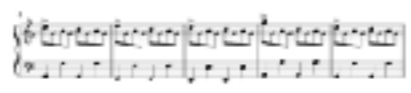


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Abacax



3. Fibonacci

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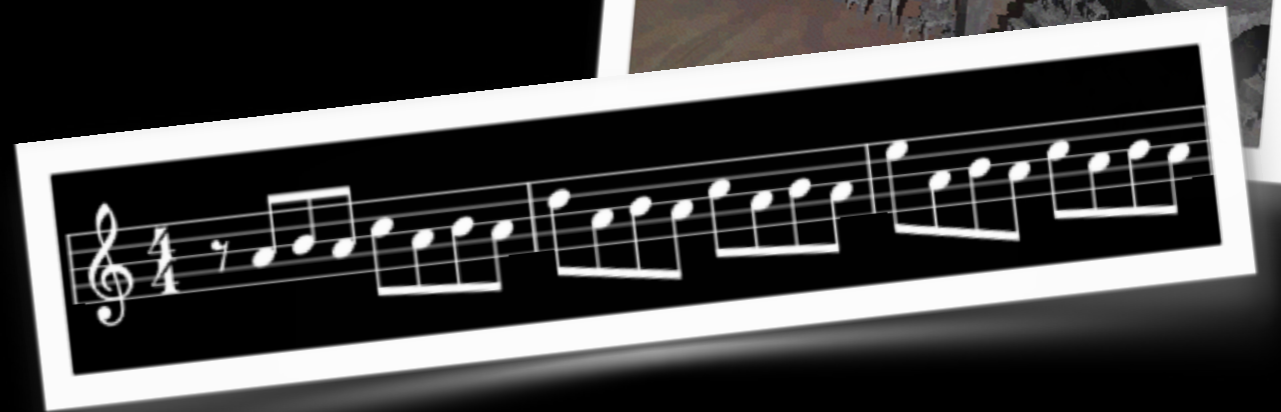
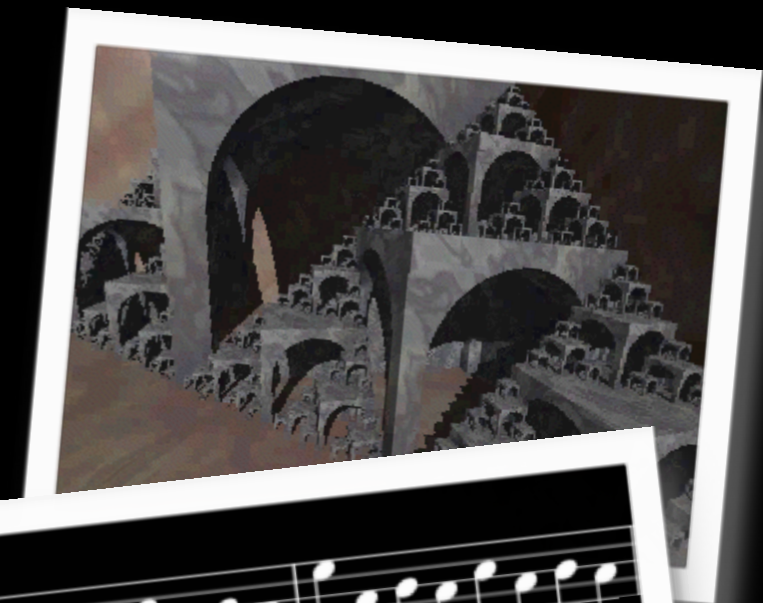
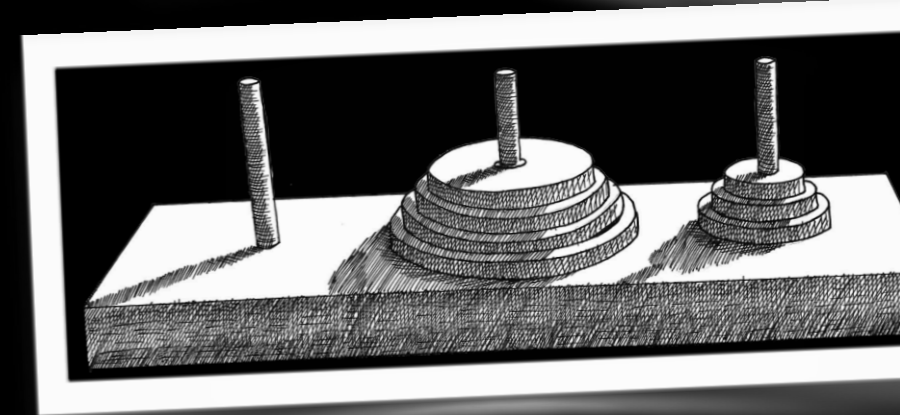
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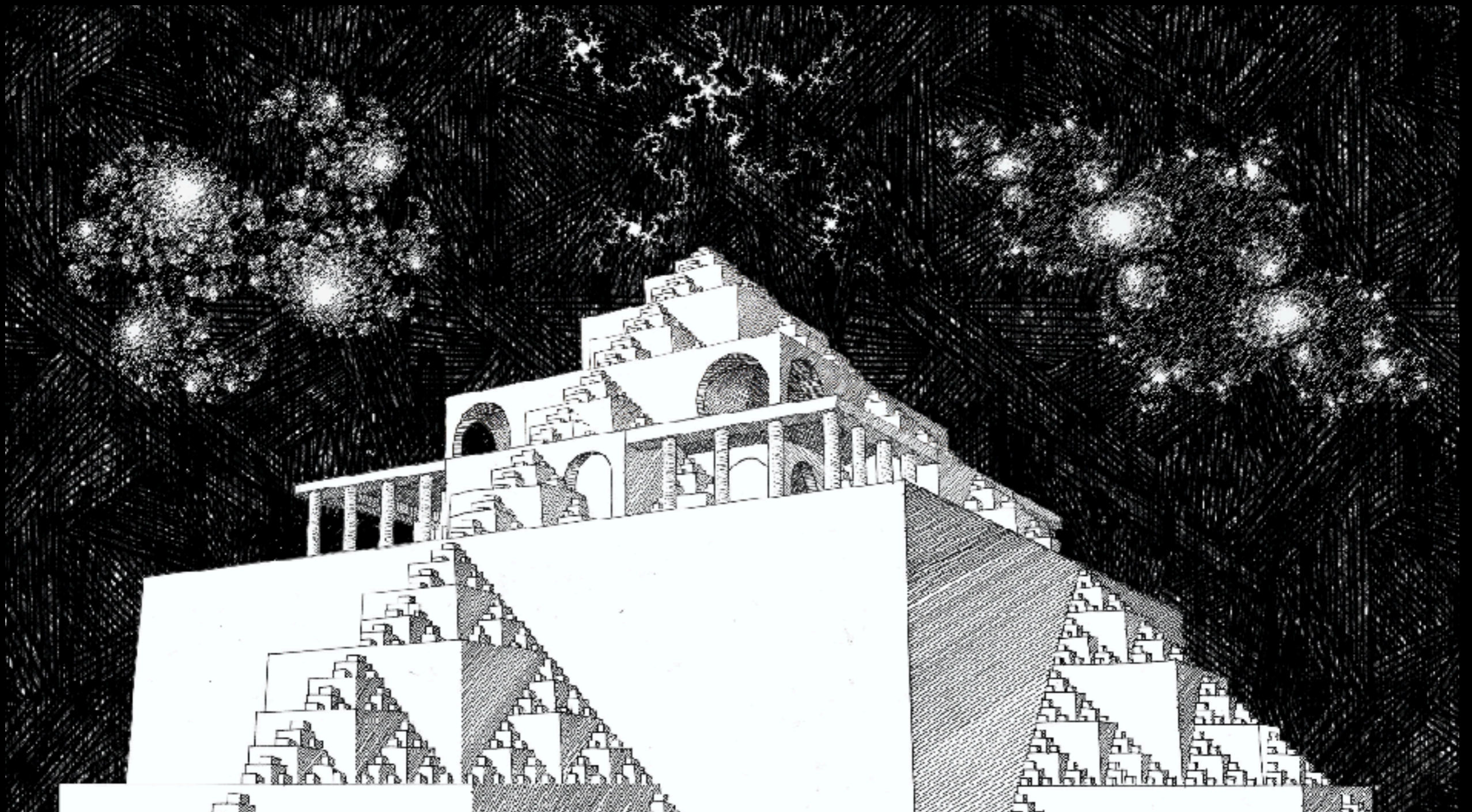
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If one pattern can inspire

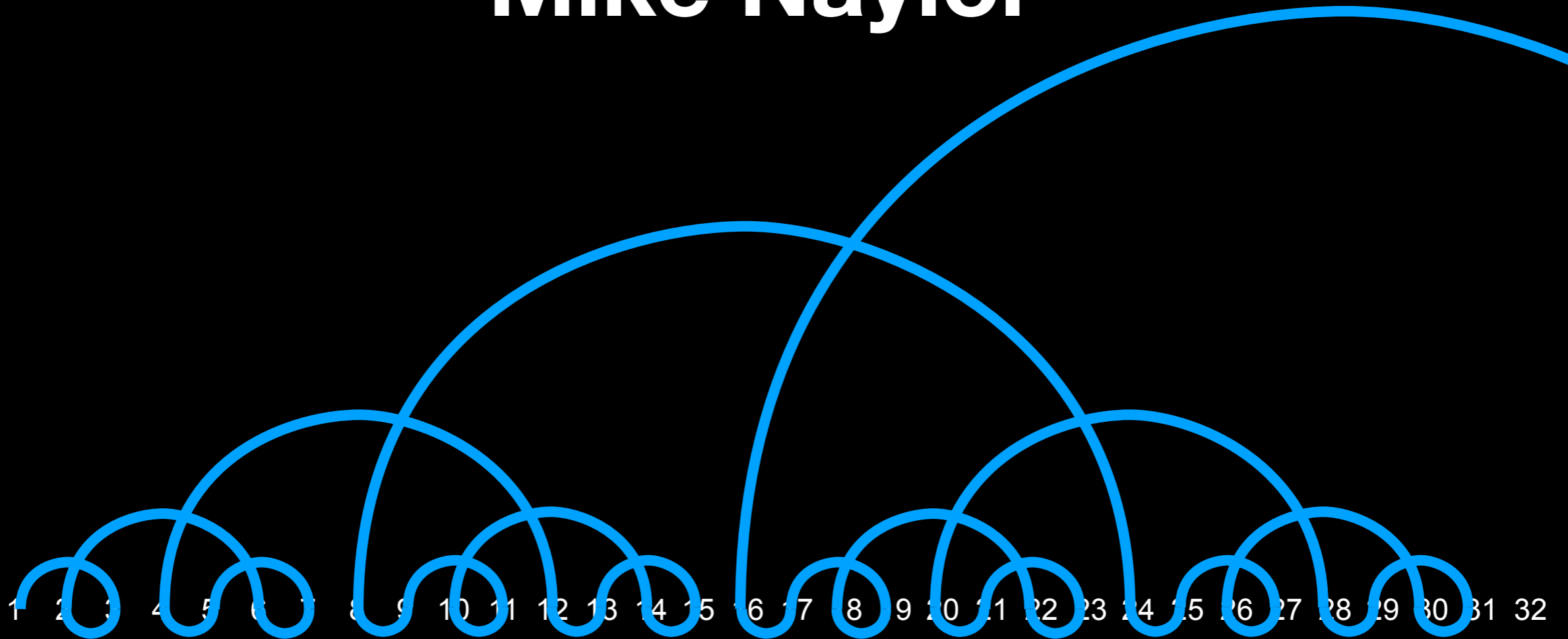
Art
Music
Poetry
Sculpture
Landscape
Architecture
and Literature





**... what might other patterns
inspire you to create?**

Mike Naylor



lots more: abacaba.org

abacabax.com