

redistricting

math, politics, and people

hi! I'm Anthony.

mathematics

Anthony.

what's in this talk

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1. a redistricting primer

what's in this talk

1. a redistricting primer
2. ... how is this related to math again?

what's in this talk

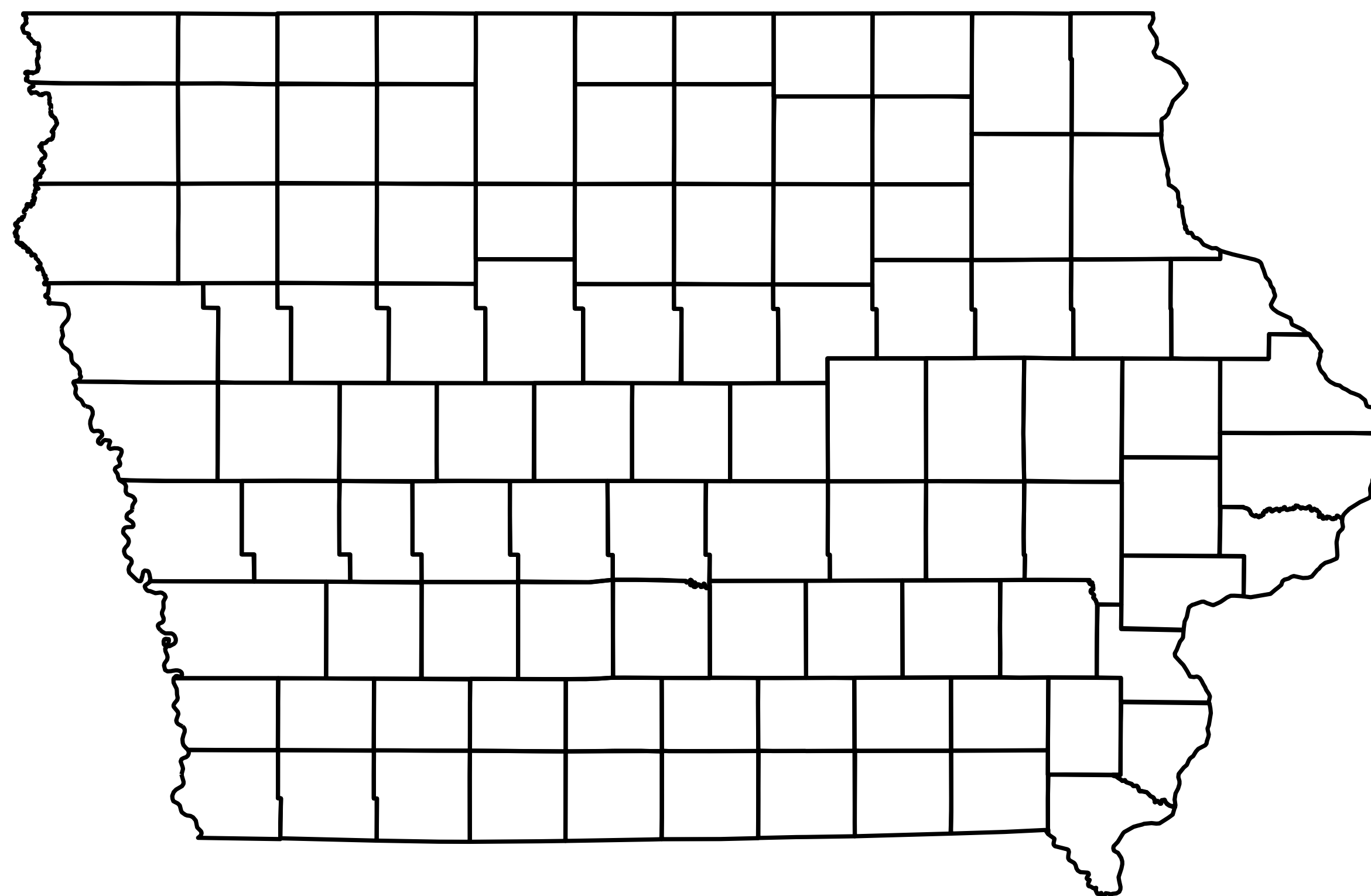
1. a redistricting primer
2. ... how is this related to math again?
3. putting things into practice

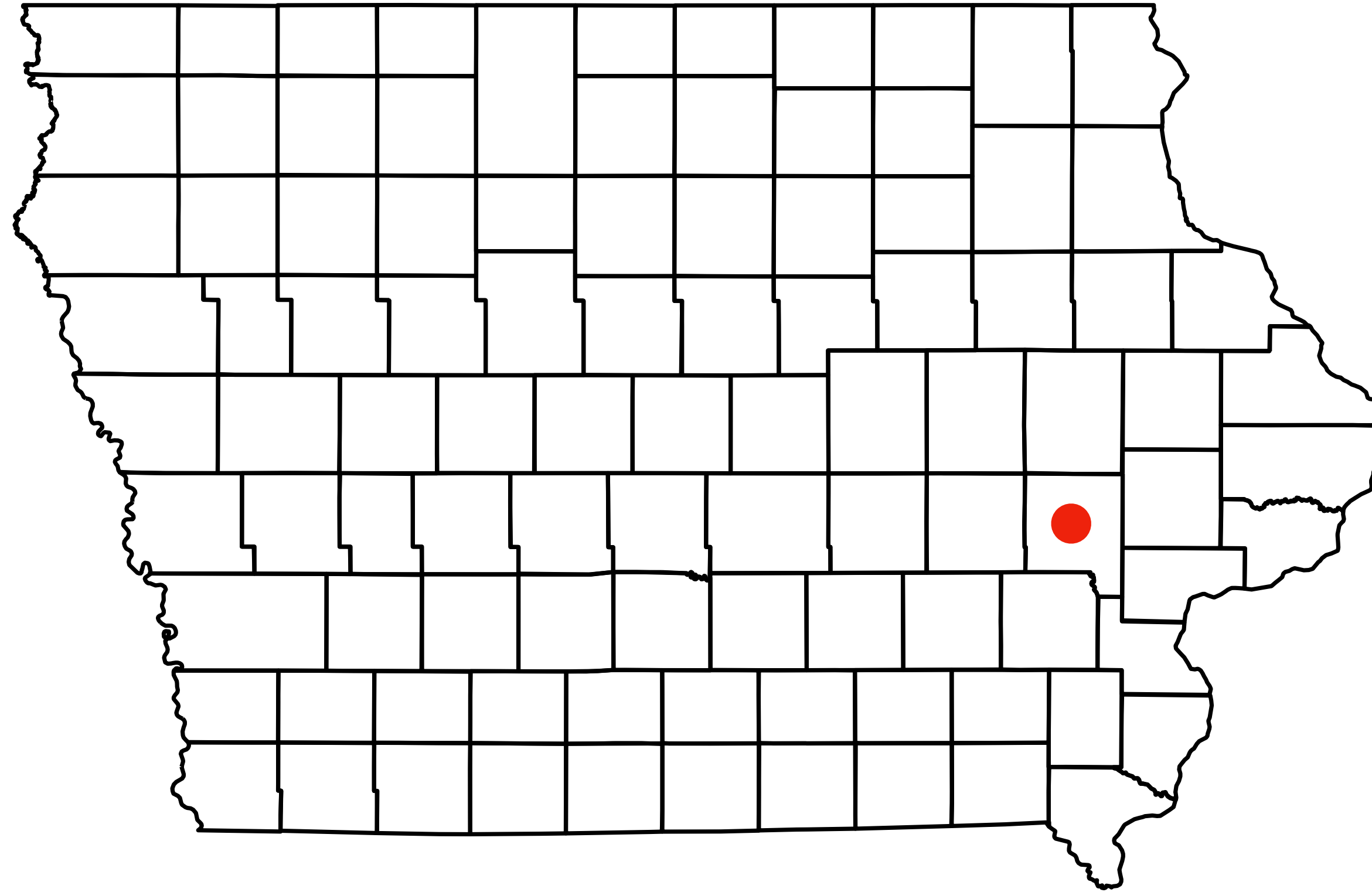
1. a redistricting primer

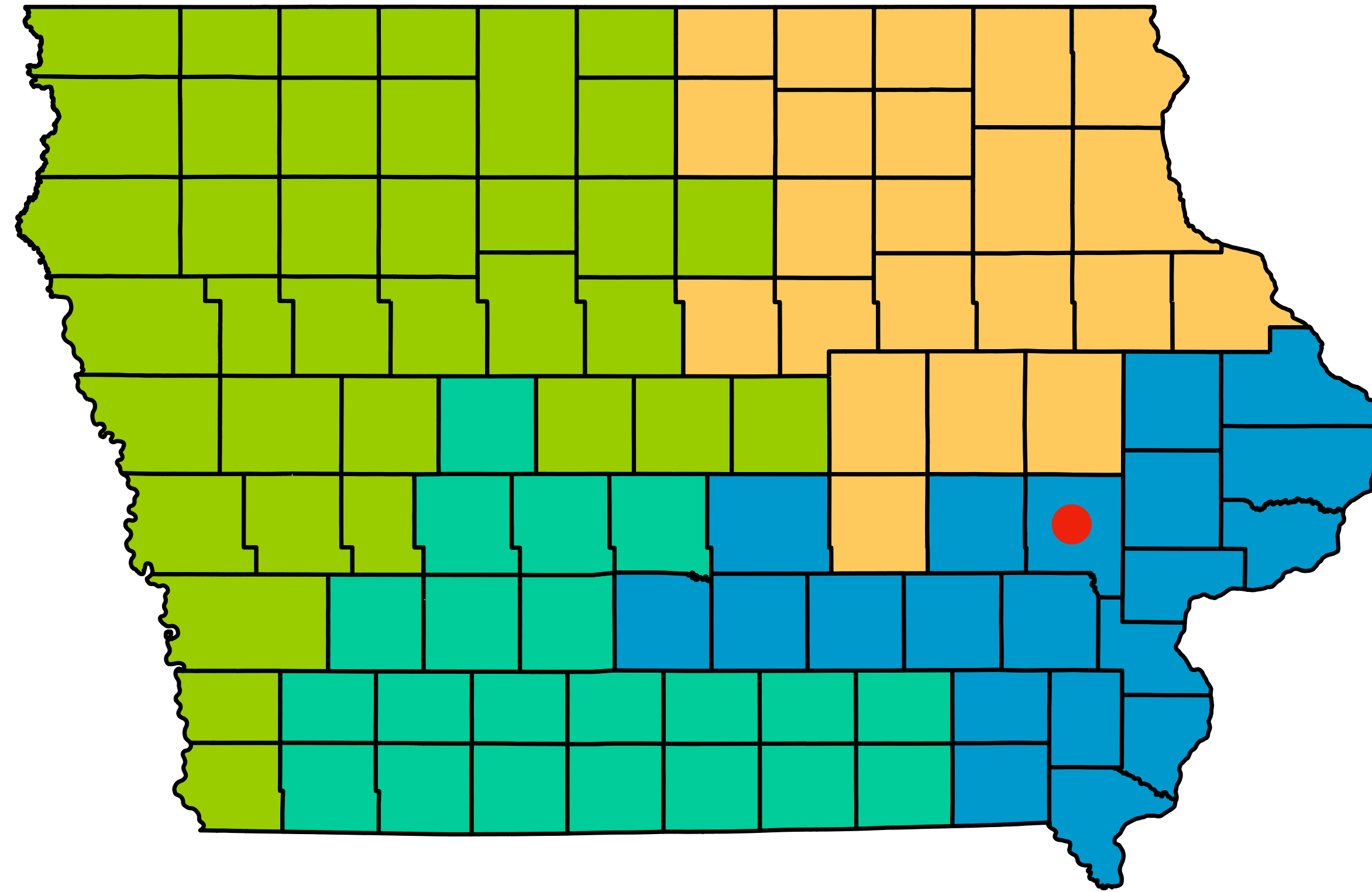
redistricting

redistricting

the practice of dividing a jurisdiction into electoral districts.







gerrymandering

gerrymandering

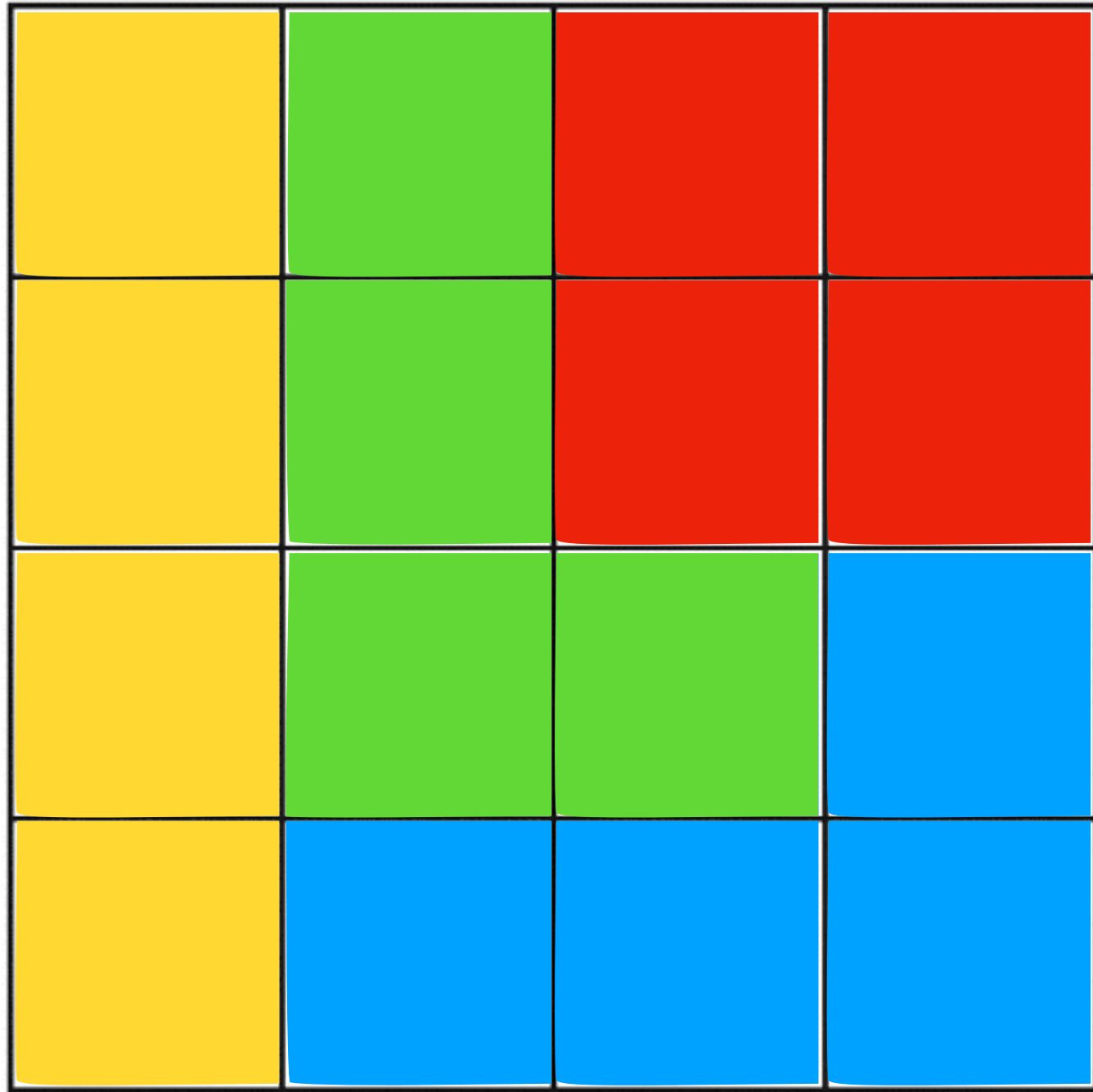
the practice of redistricting to favor *or disfavor* a specific group.

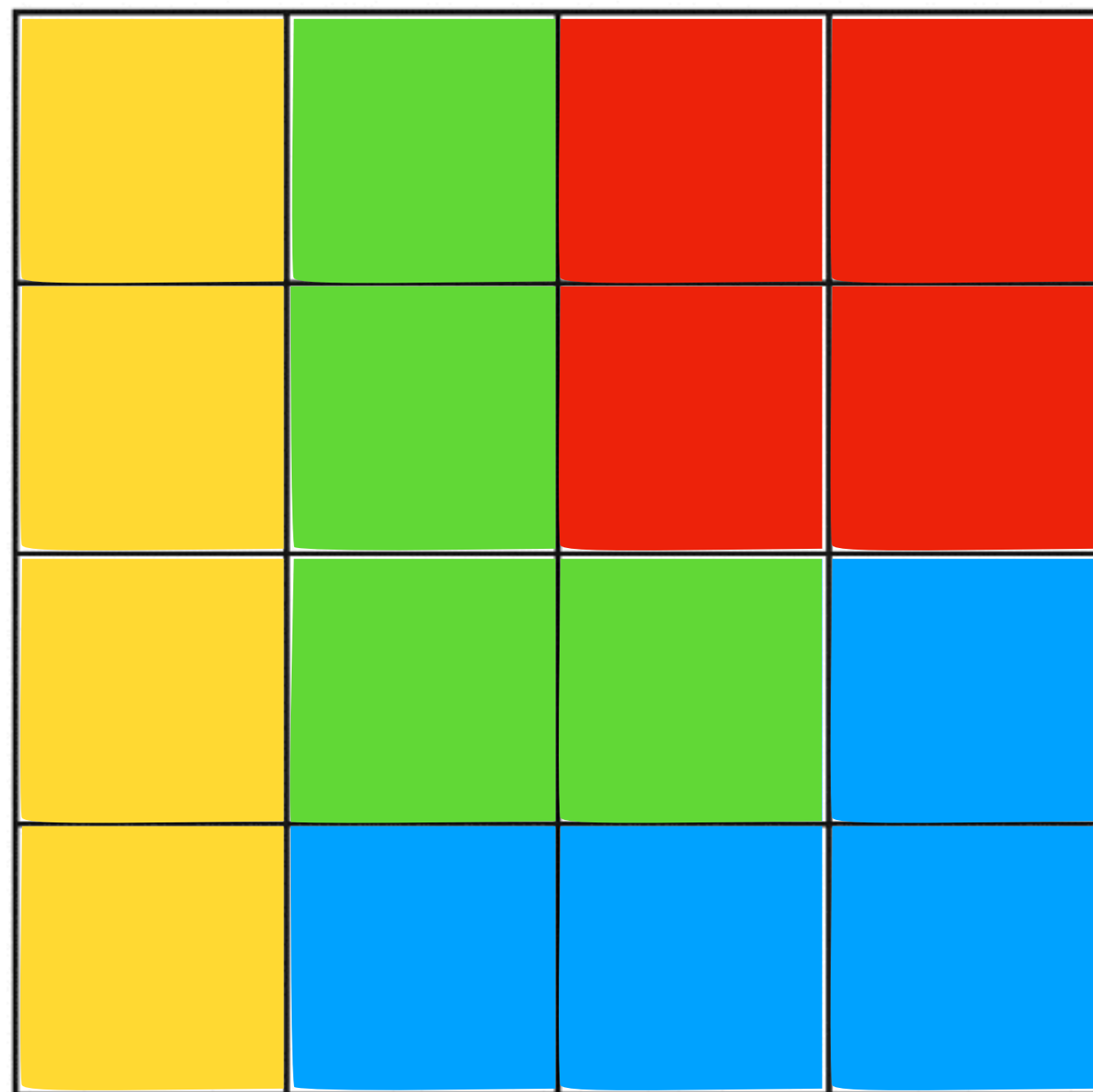
redistricting is a voting rights issue.

redistricting is a issue.

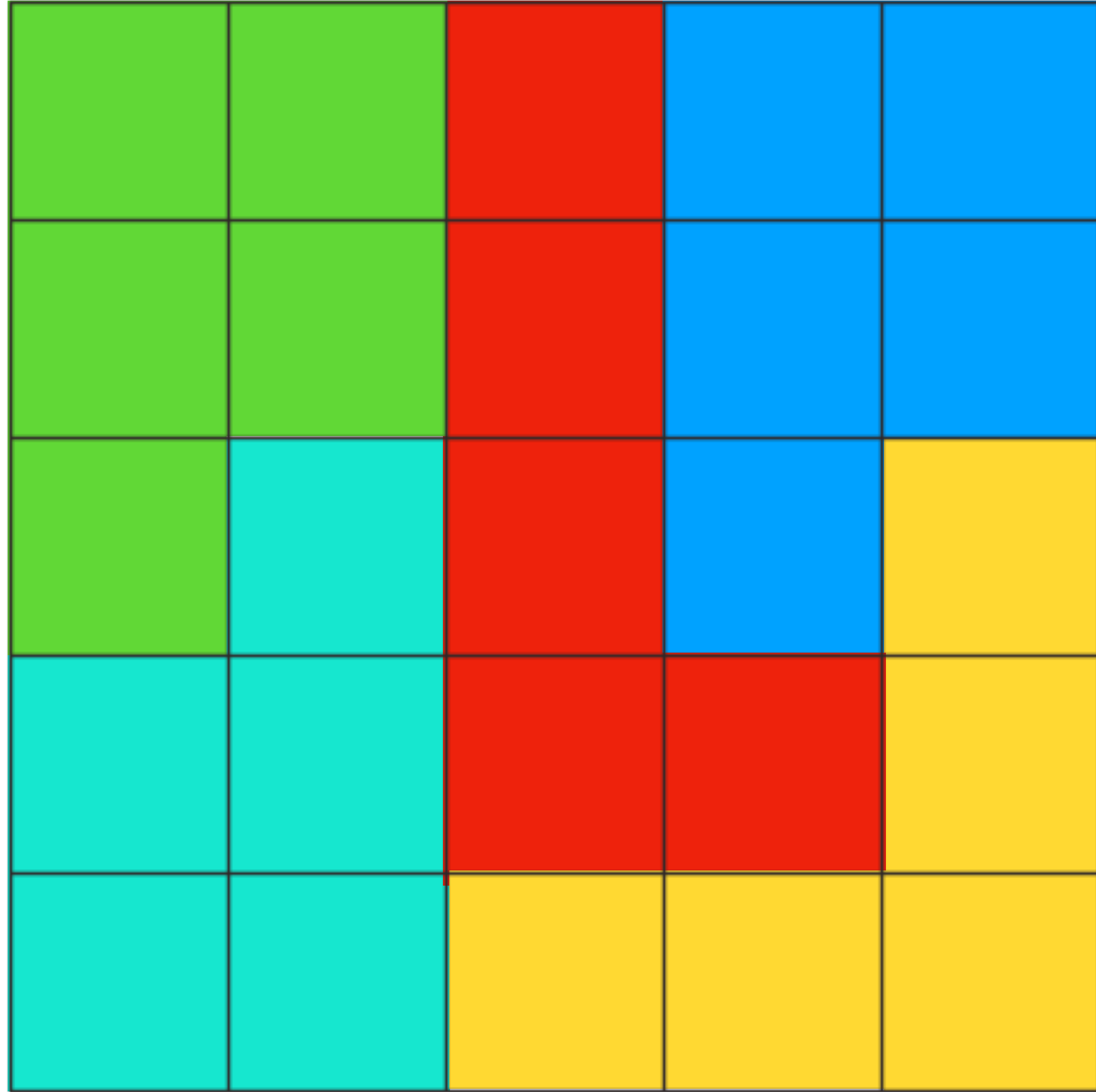
redistricting is a human issue.

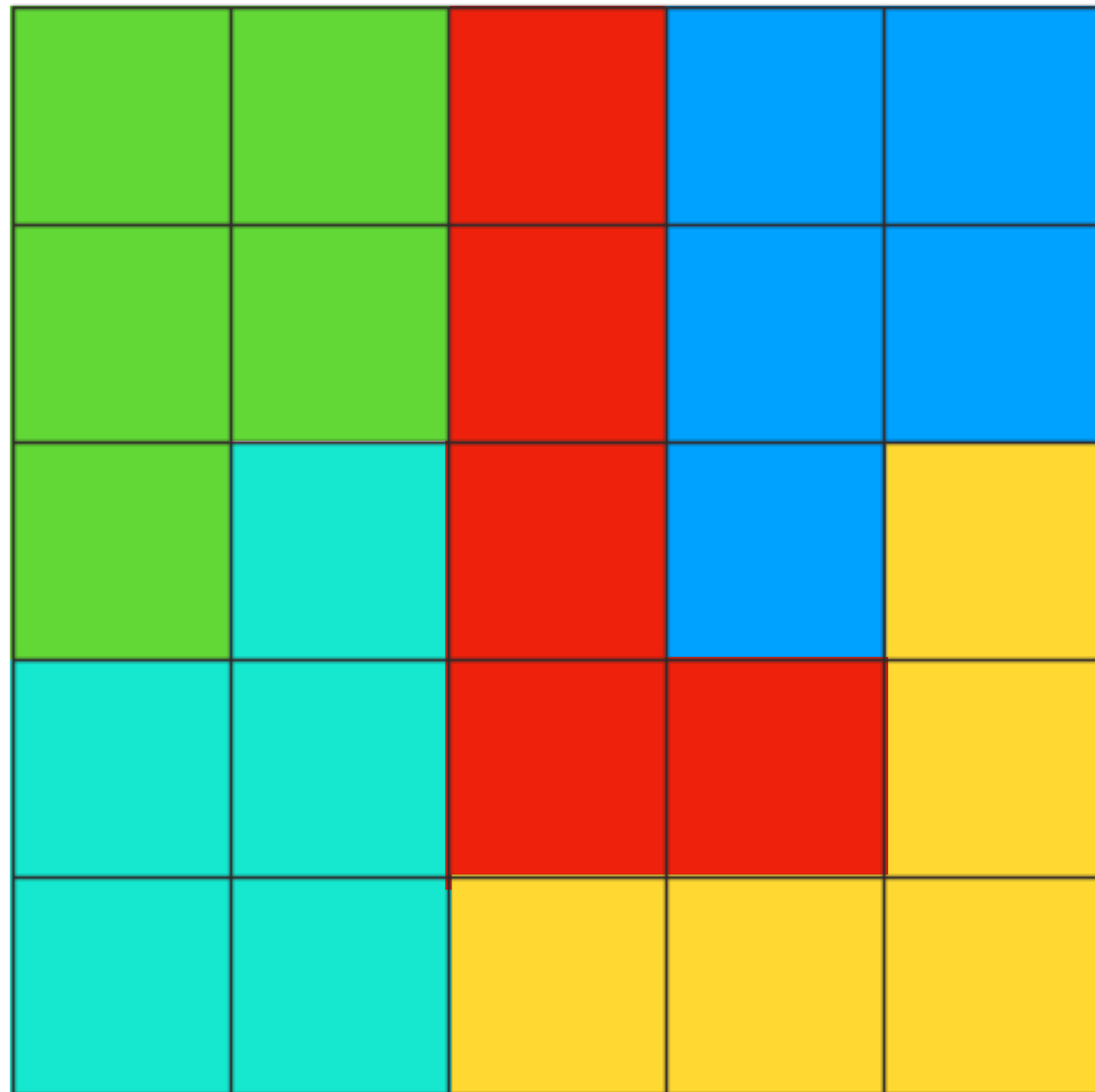
2. ... how is this related to math again?



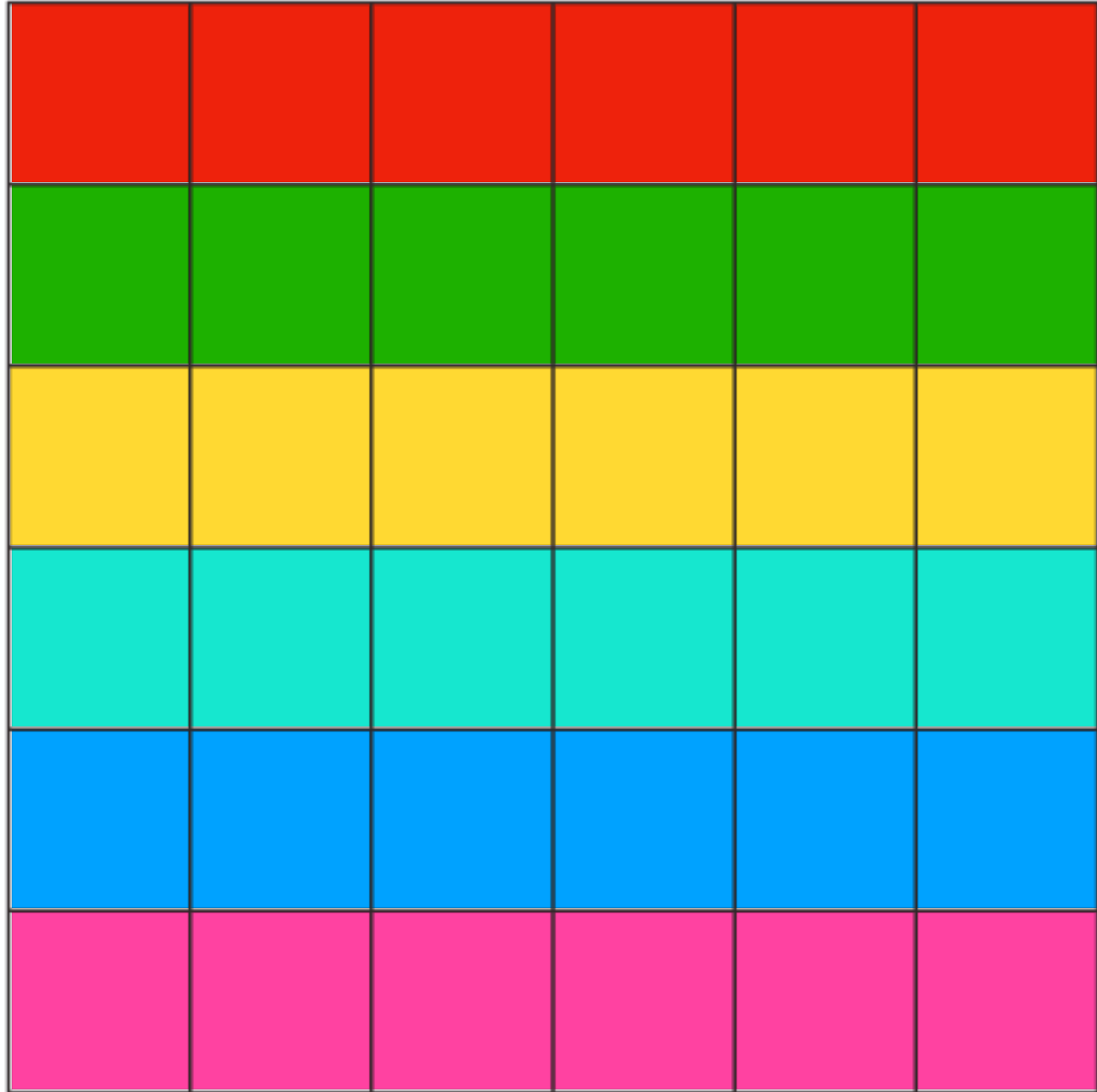


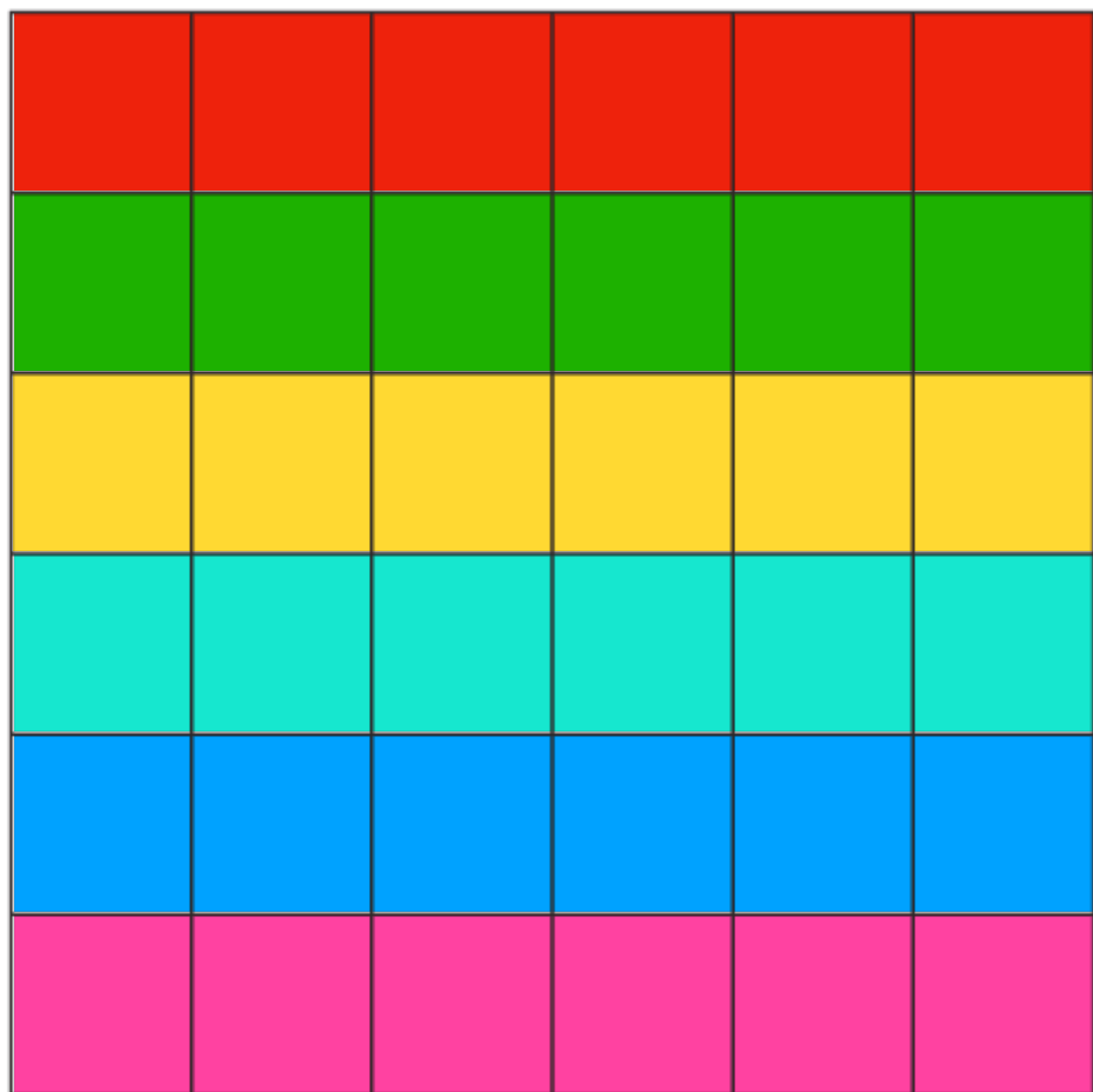
117



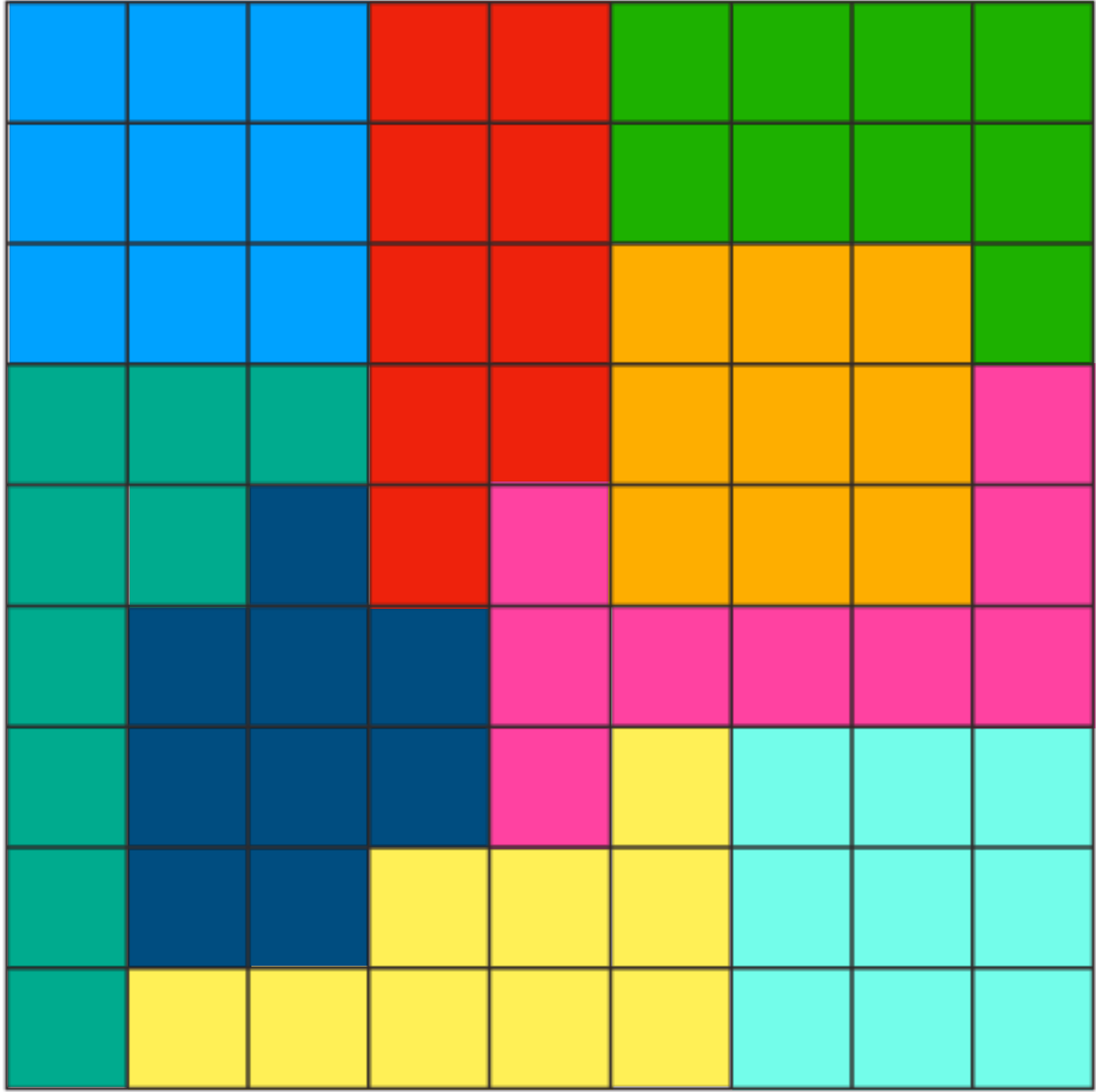


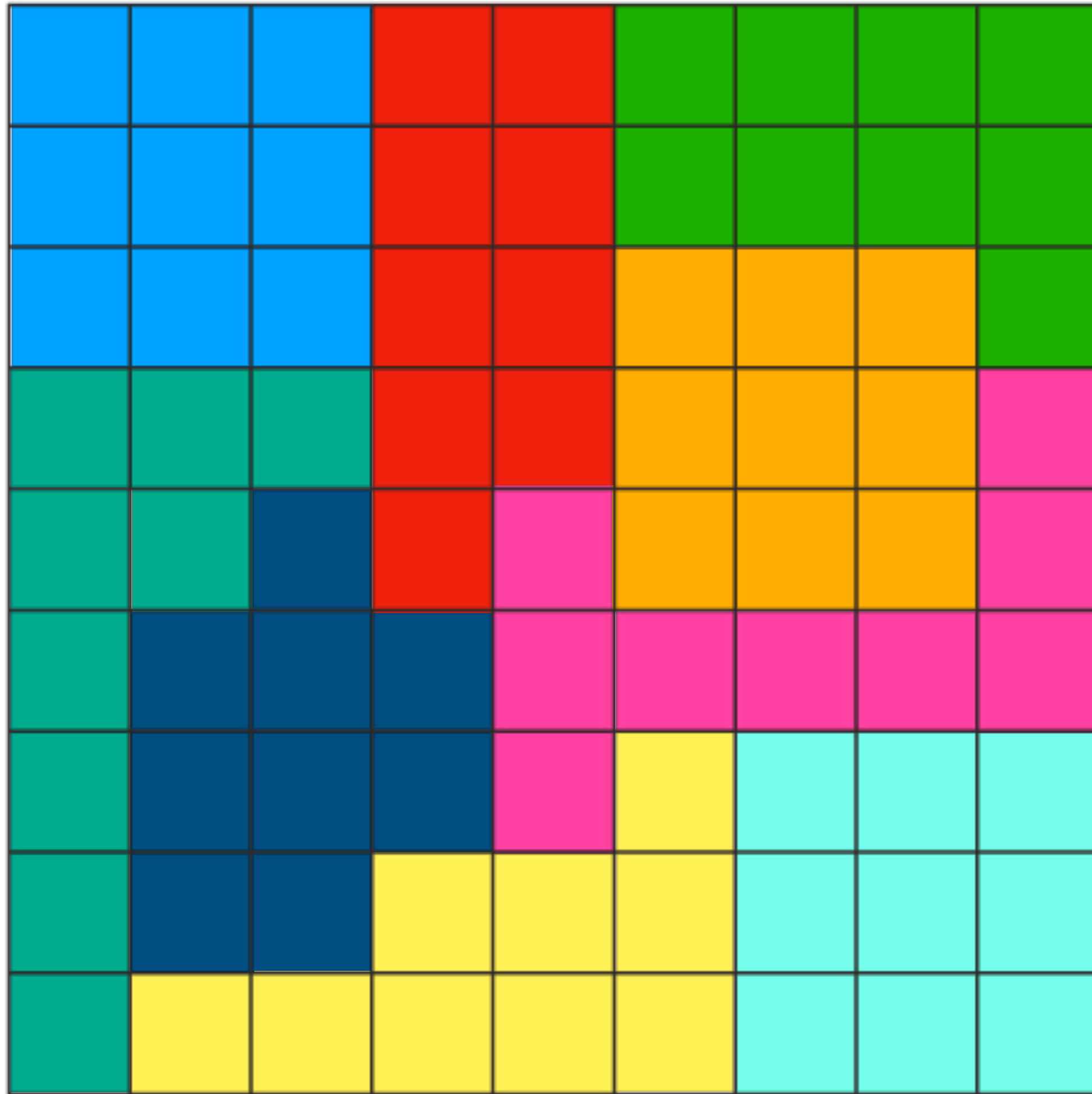
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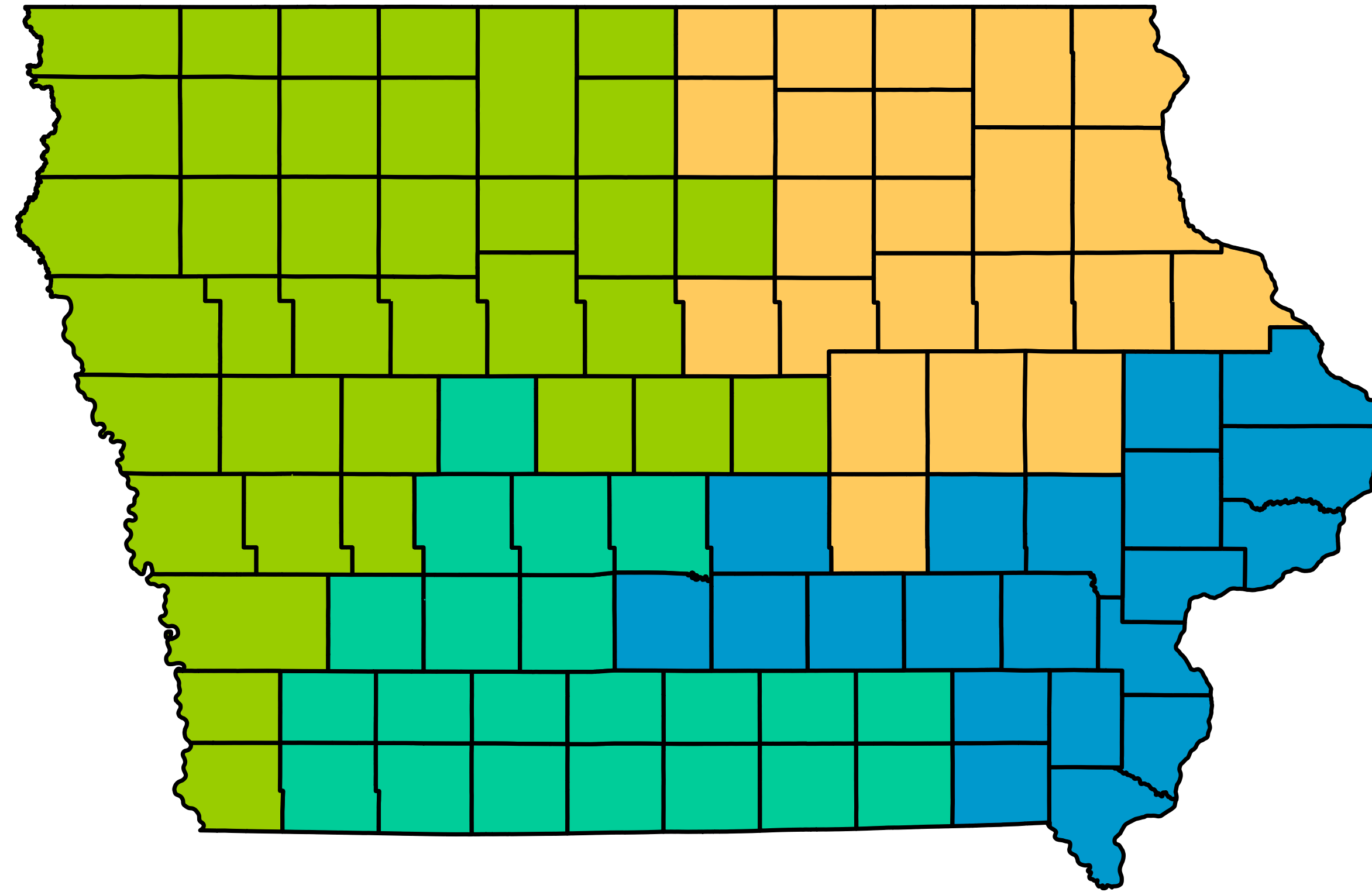


451,206

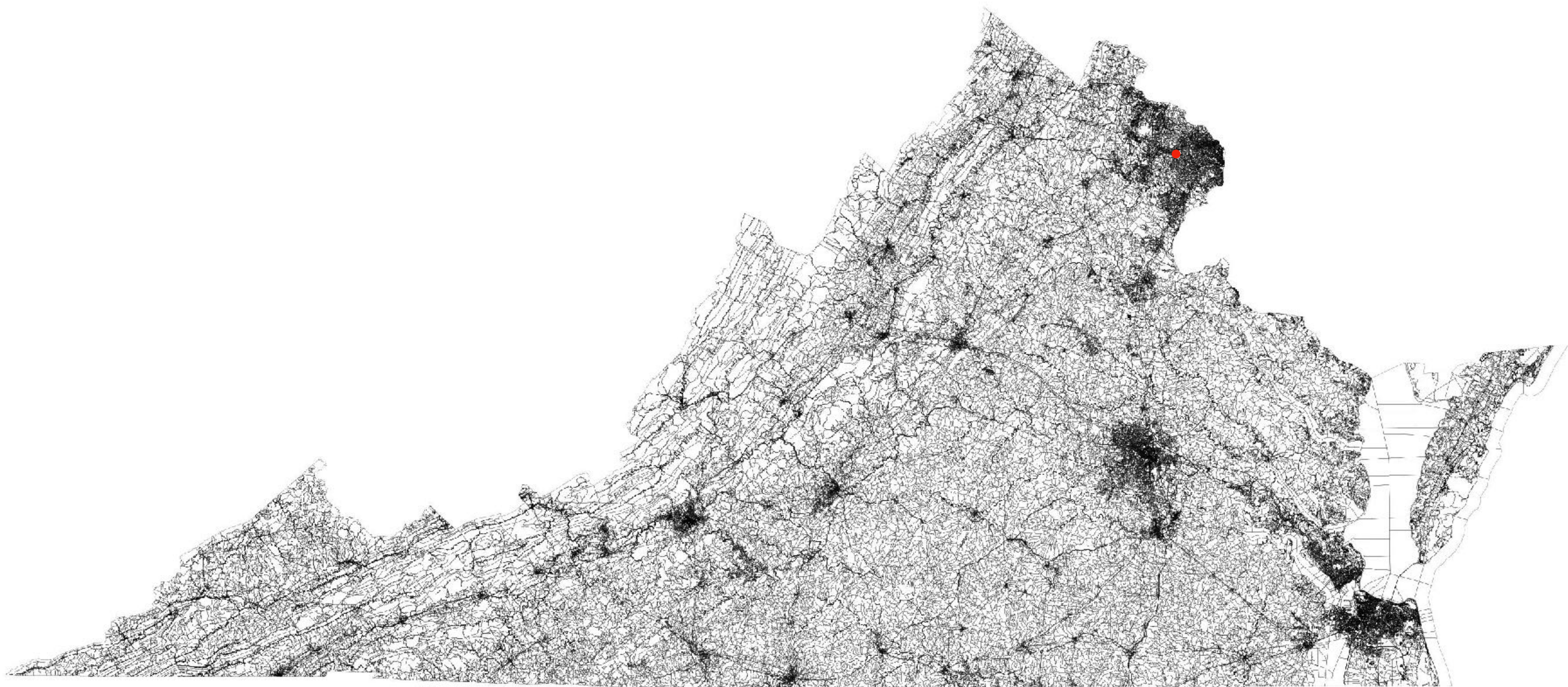




706,152,947,468,301







Monte Carlo Markov chain

MCMC

a. large

- a. large
- b. contains districting plans that are “valid”

Markov chain

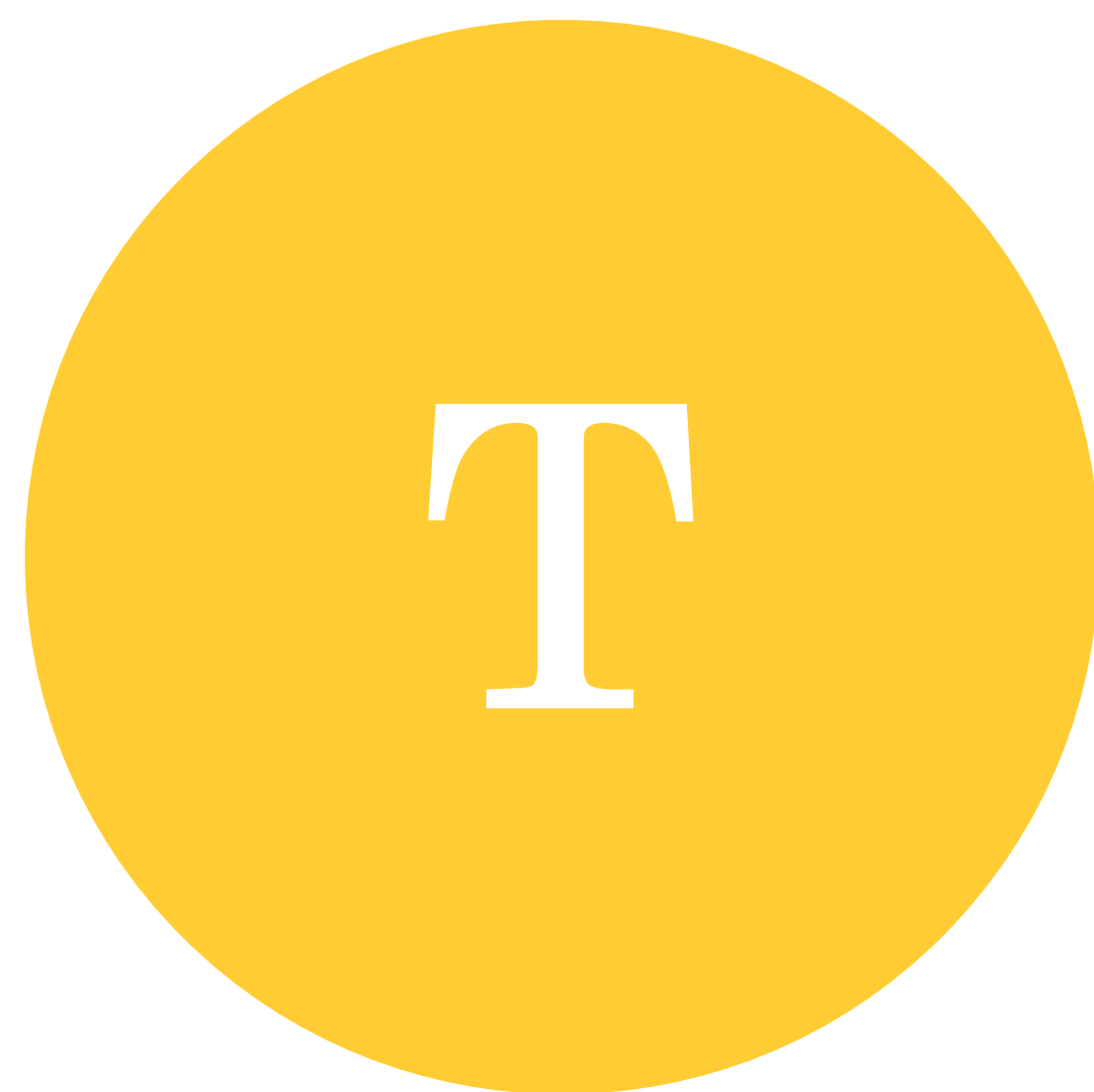
Markov chain

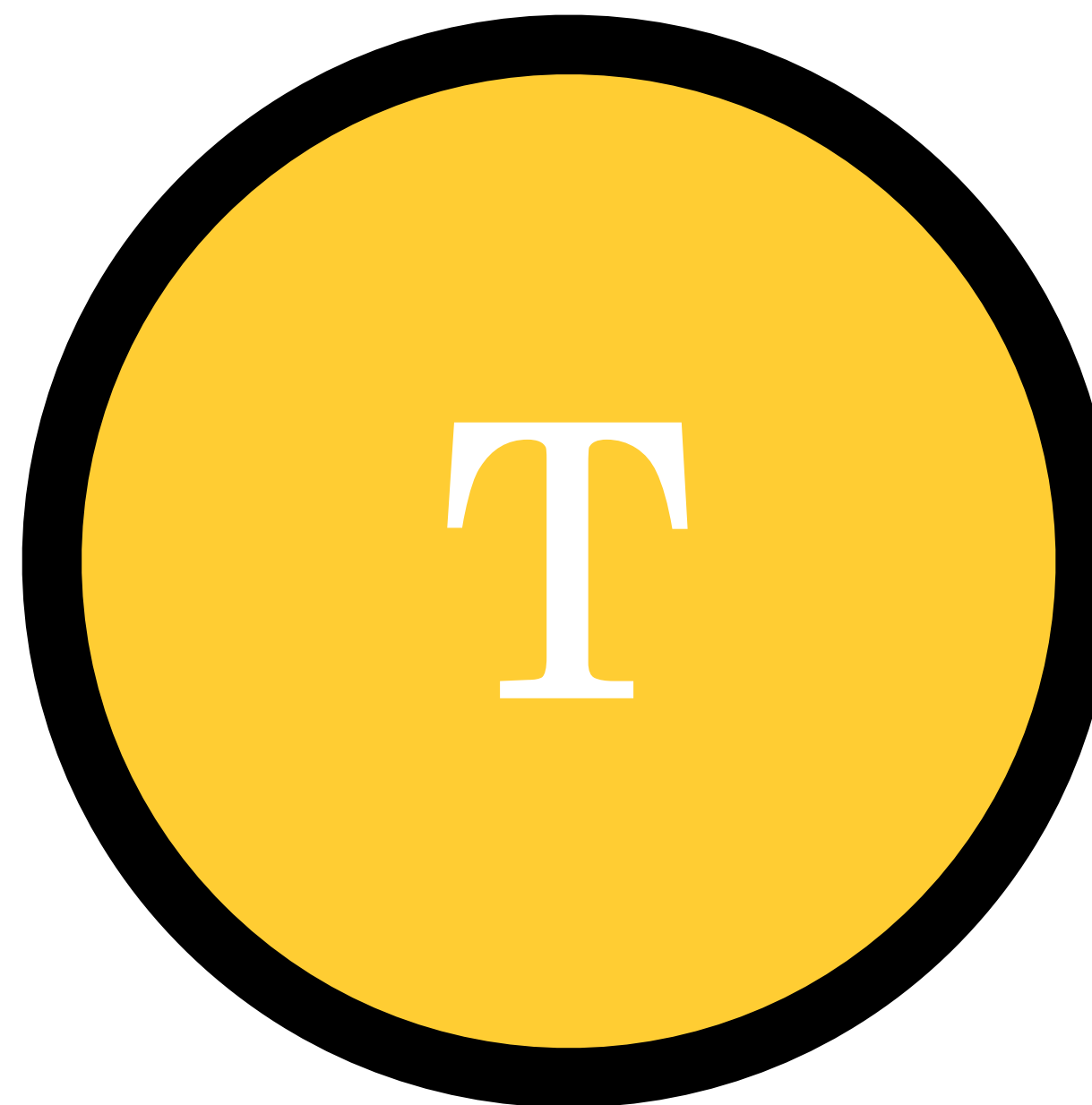
a random process equipped with the memoryless property.

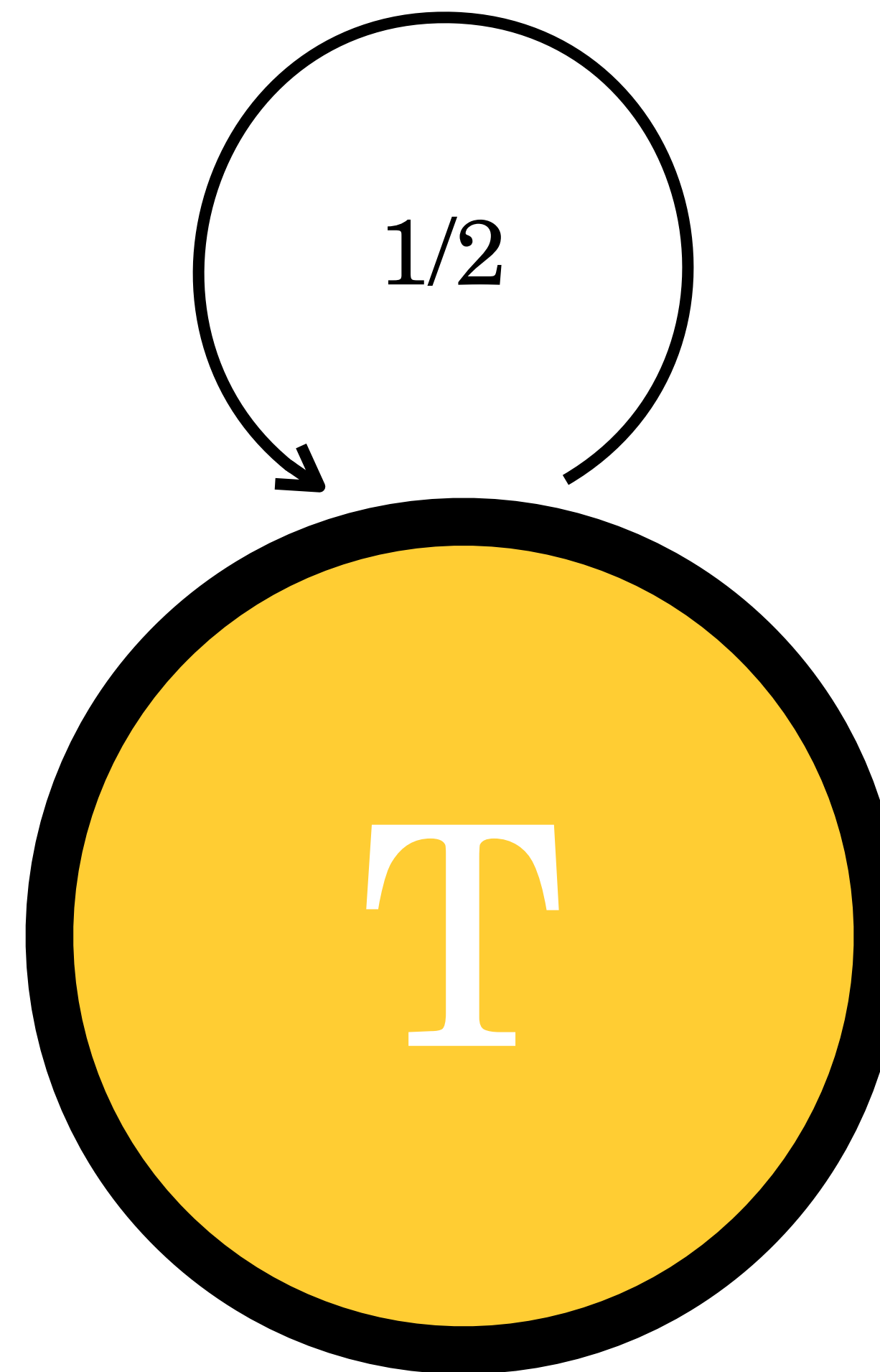
Markov chain

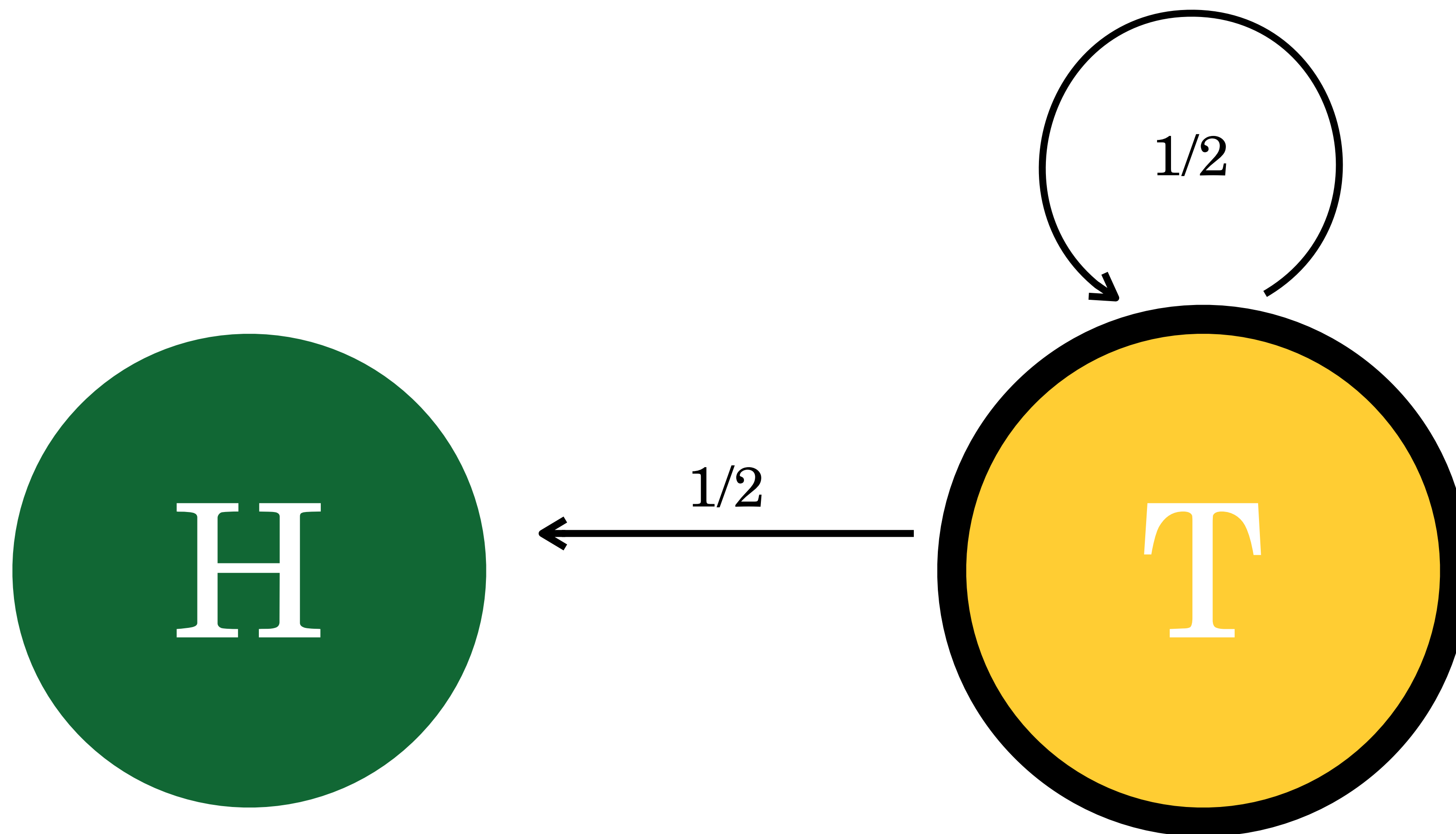
Markov chain

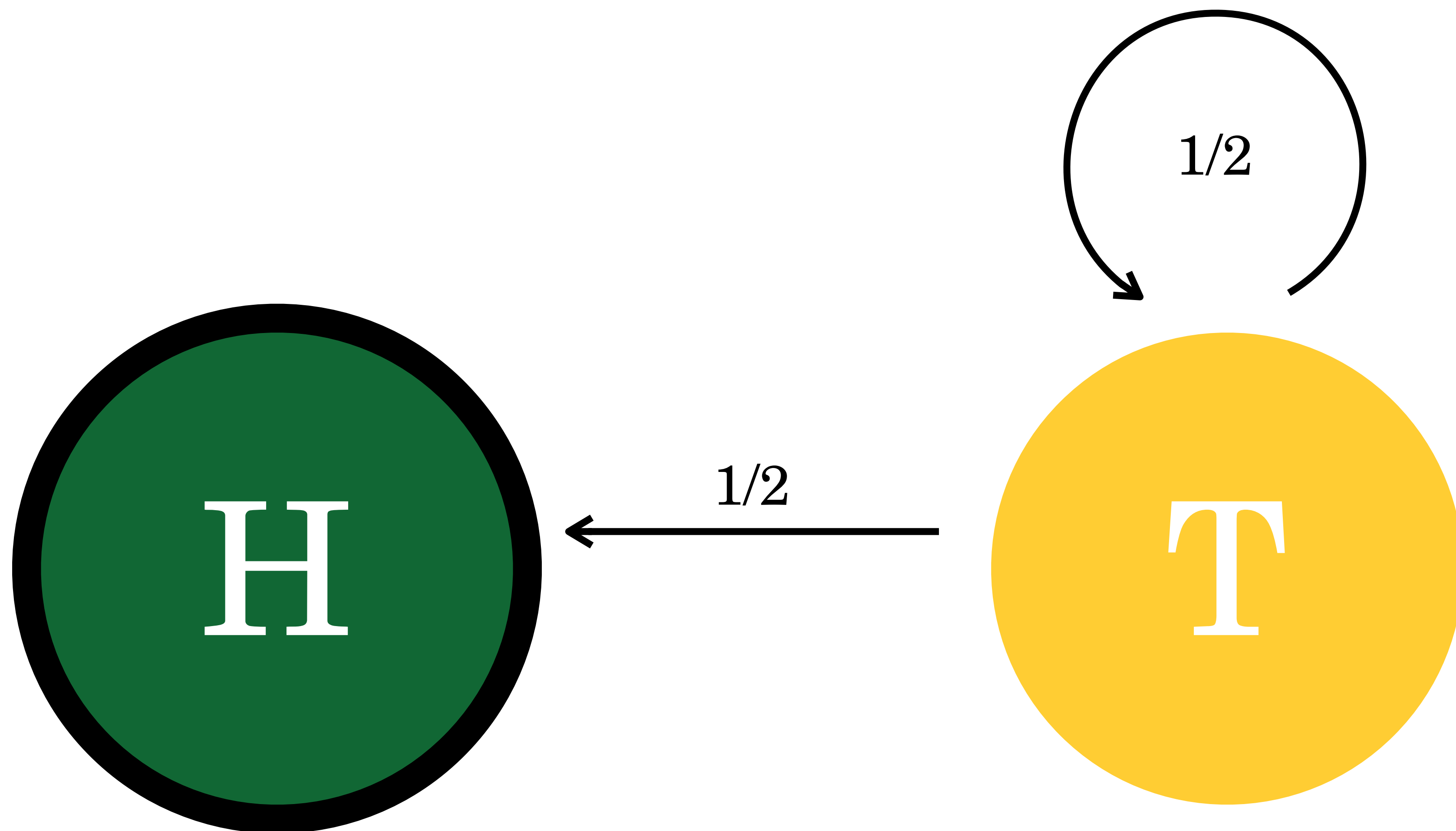
a series of draws from a random variable where the outcome of the next draw depends only on the outcome of the current one.

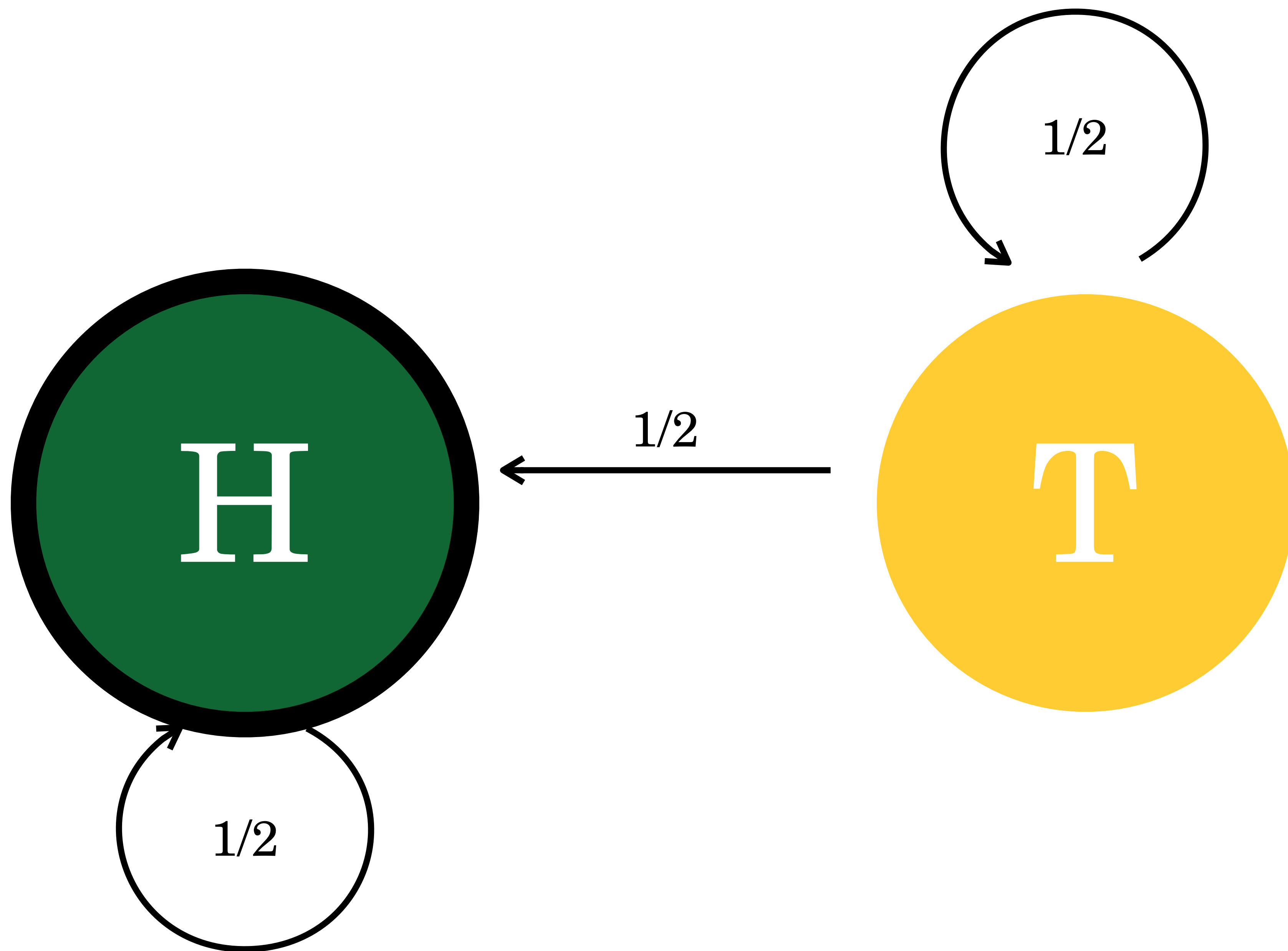


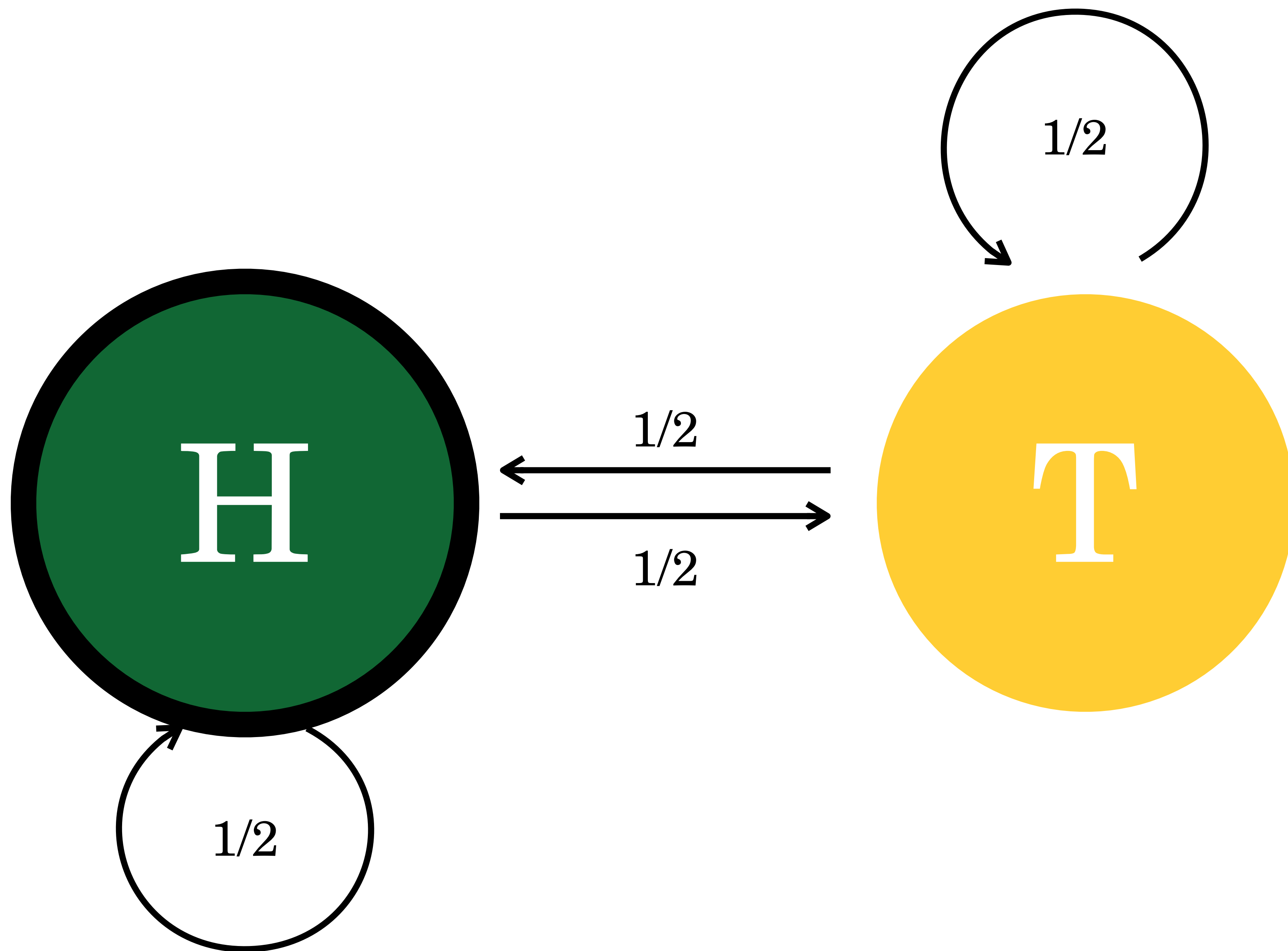


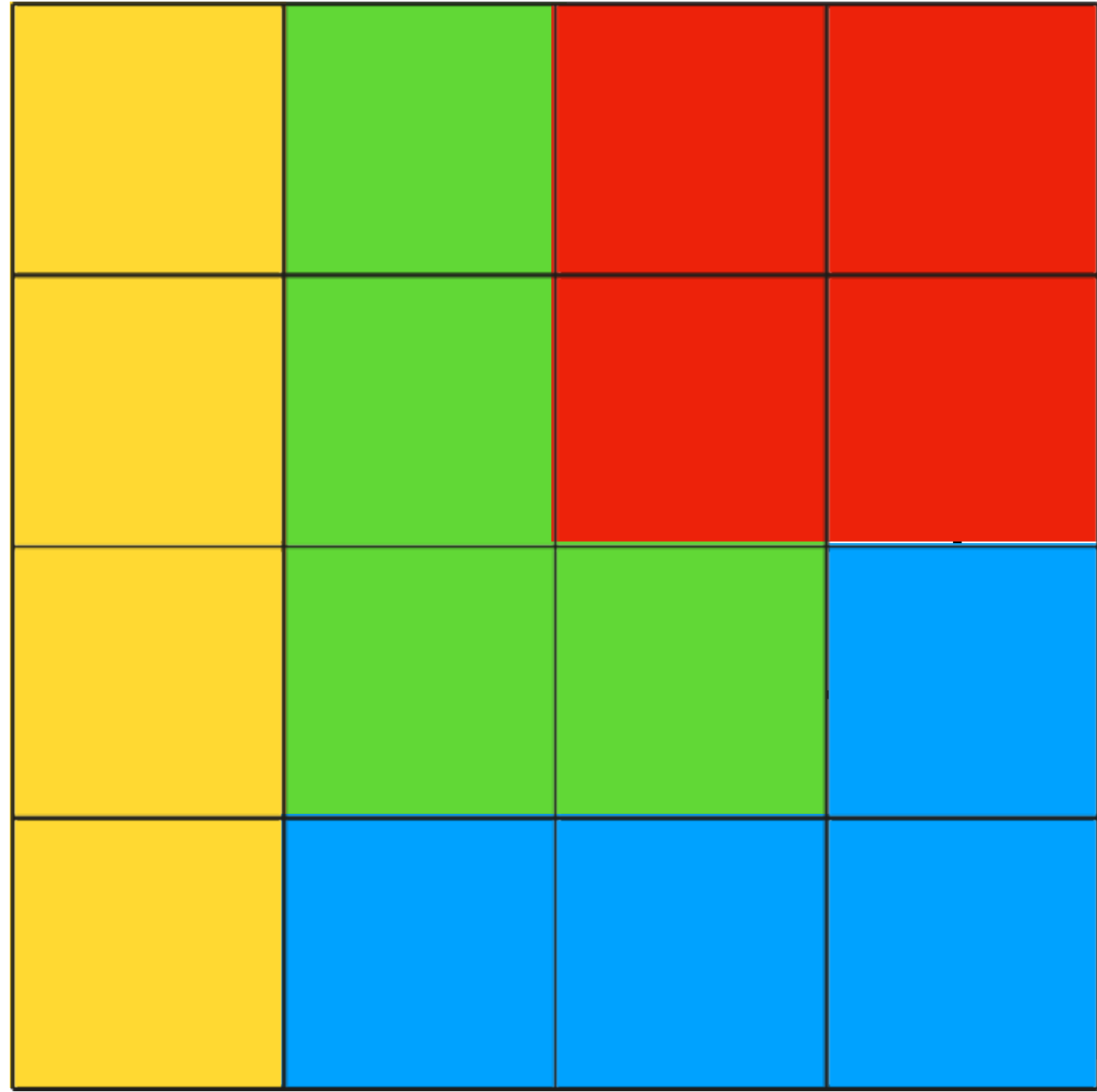


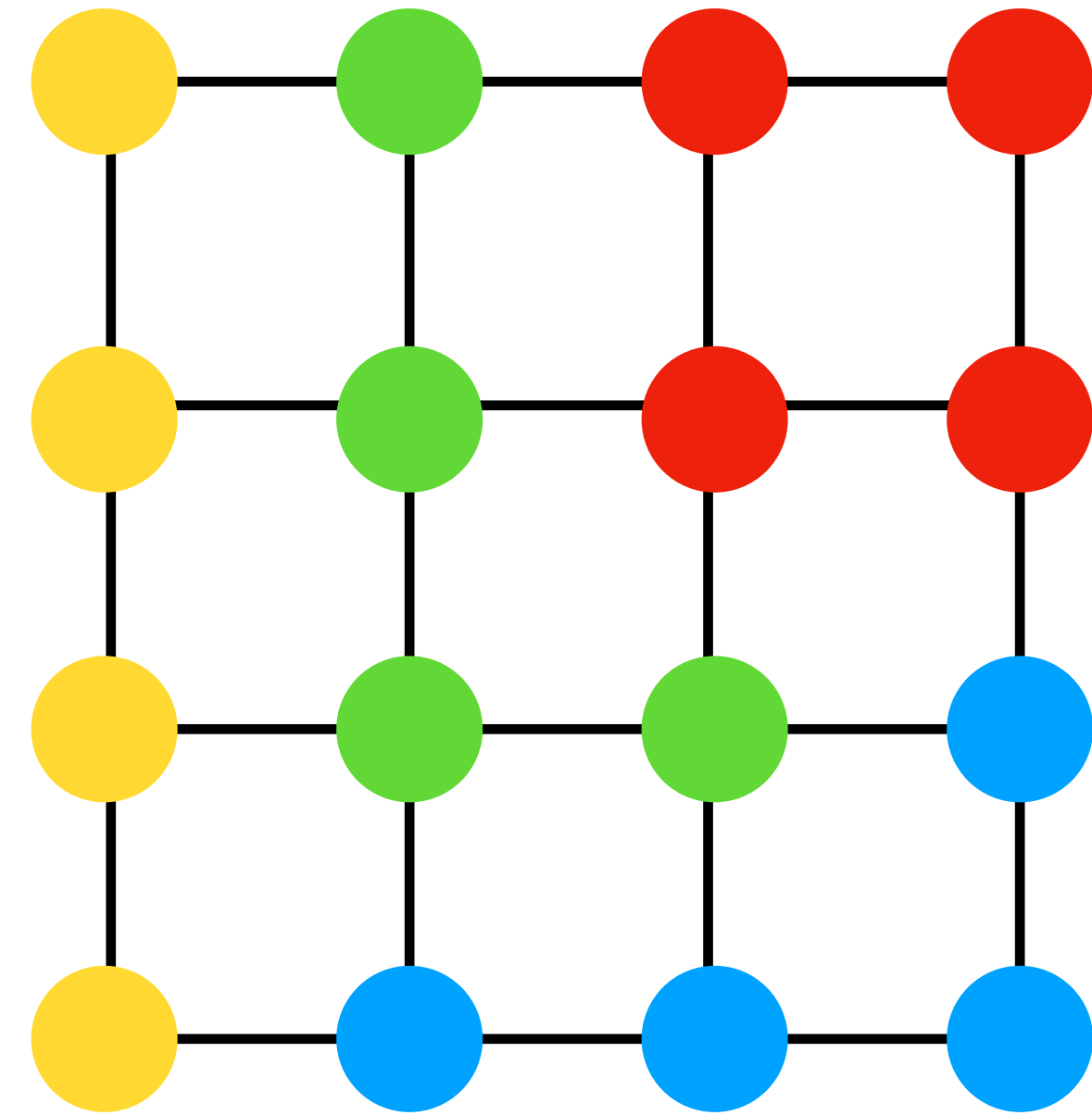
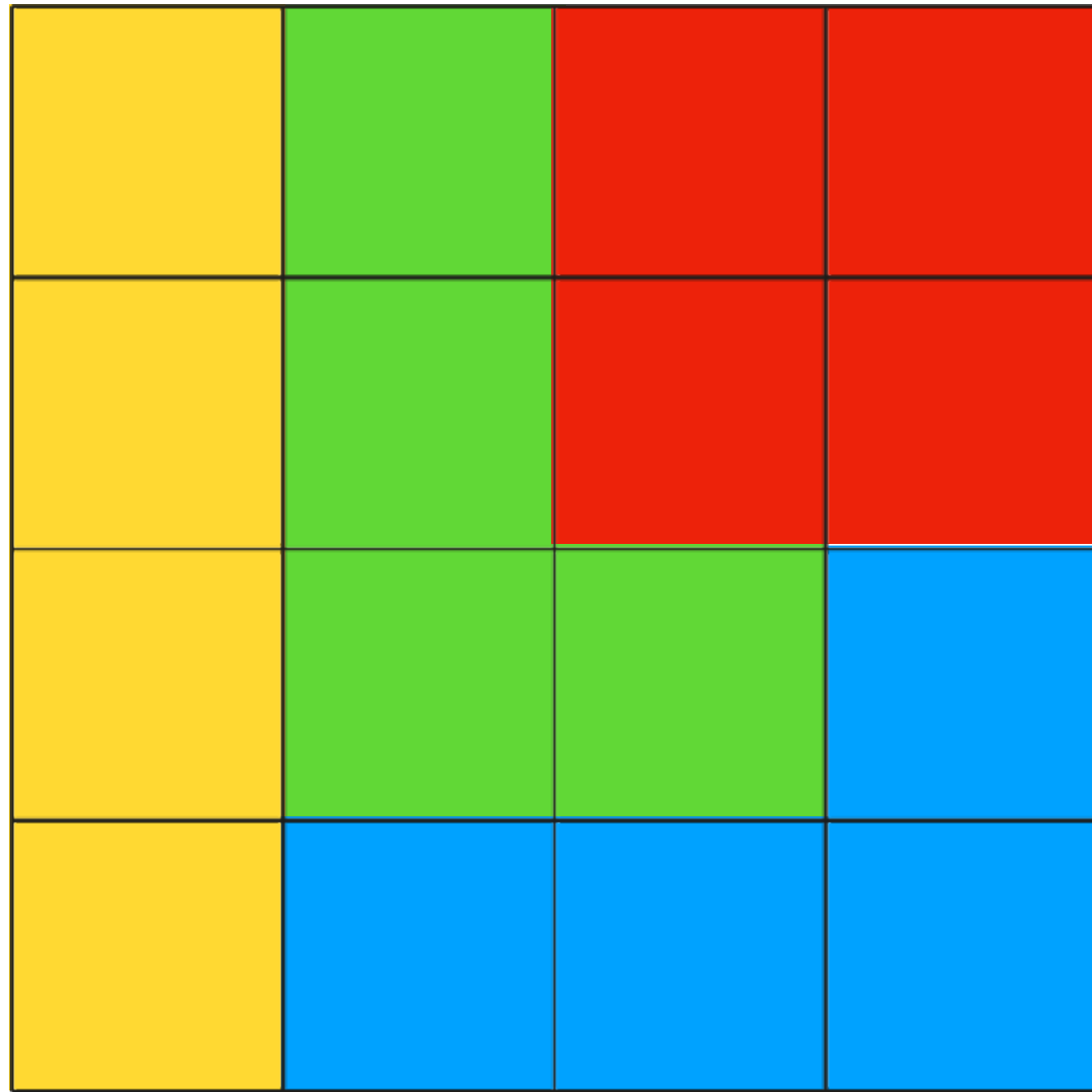








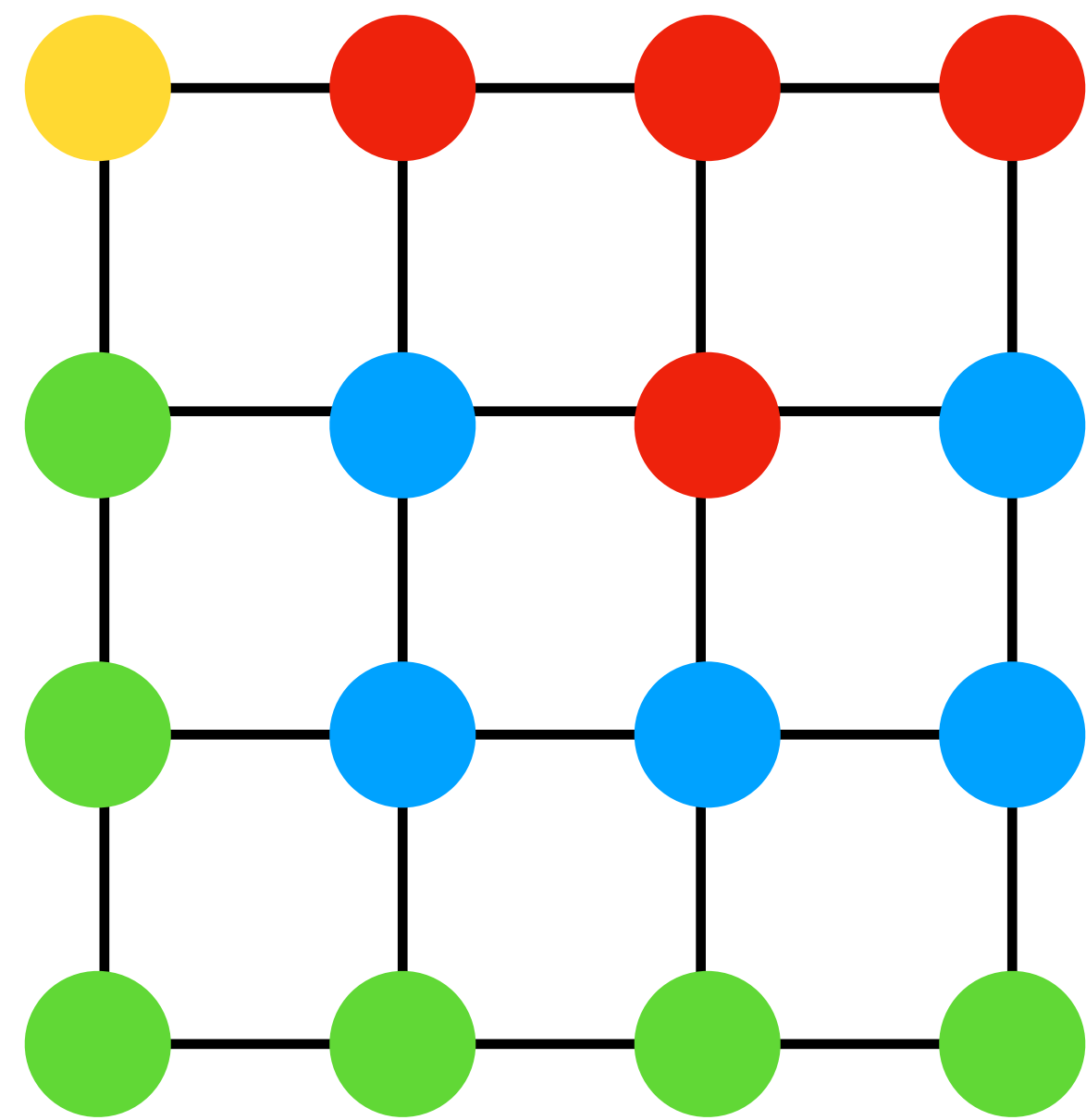




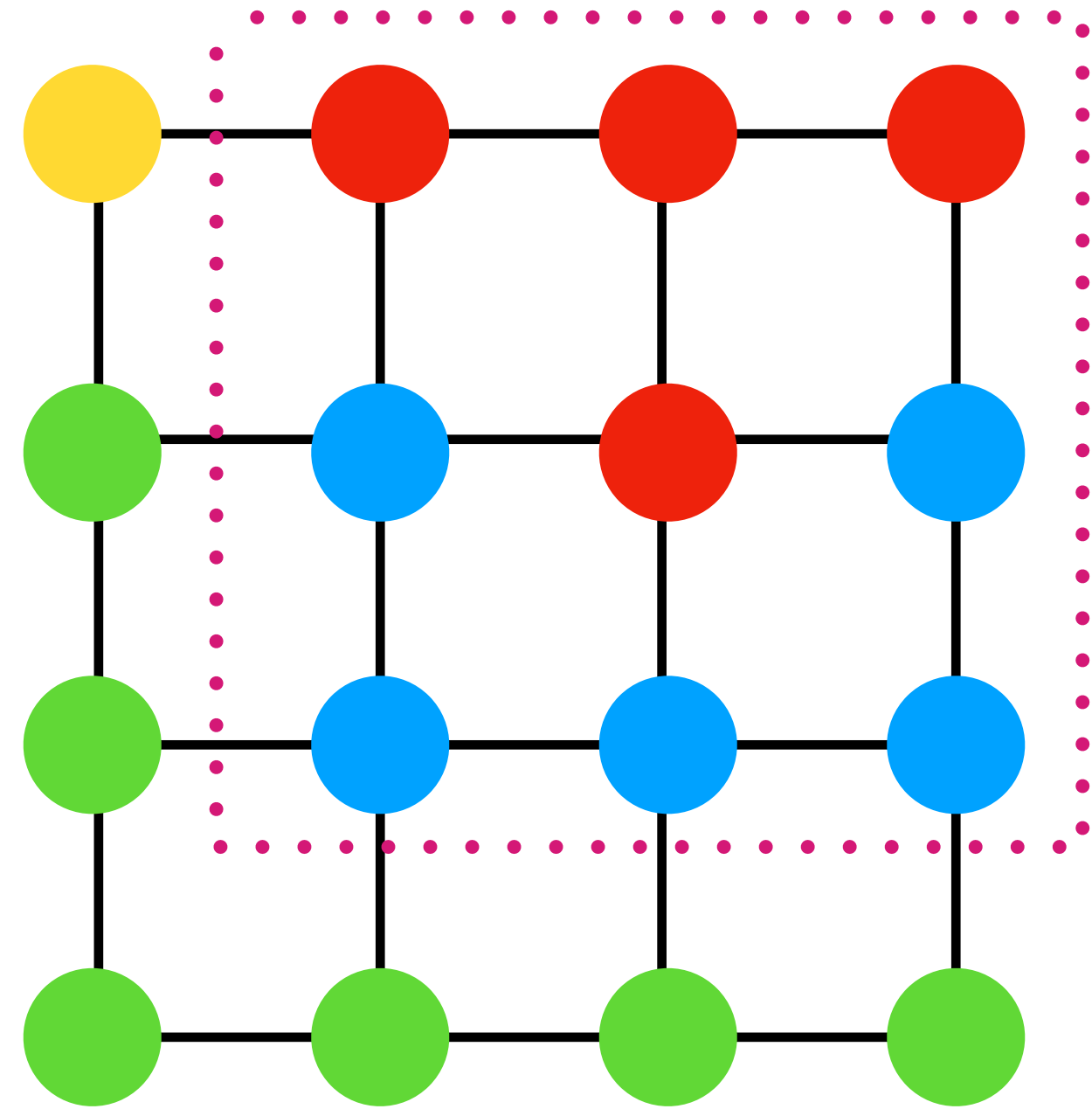
ReCom

ReCombination

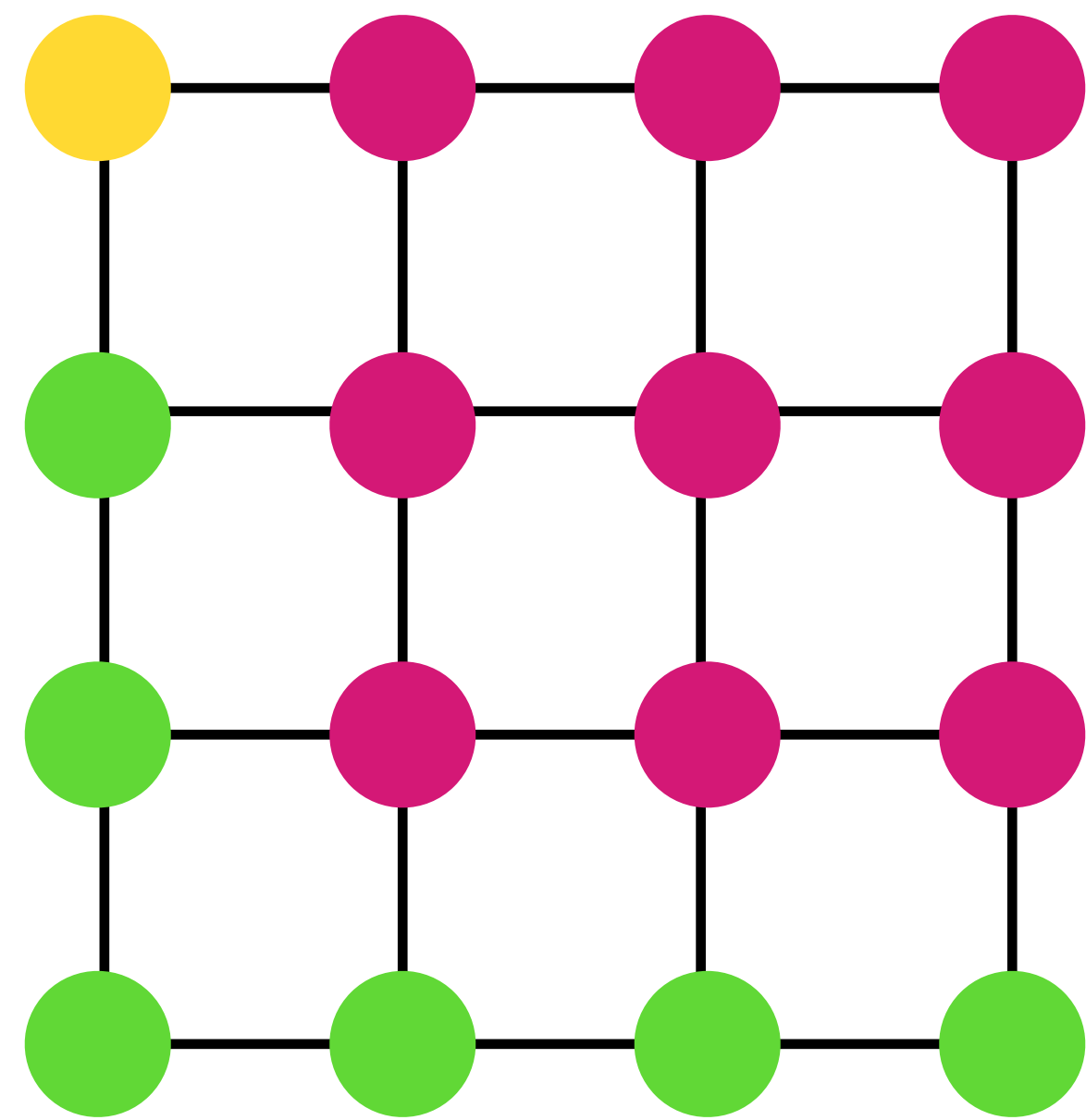
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1	2	1	0
1	1	1	0
1	0	0	1



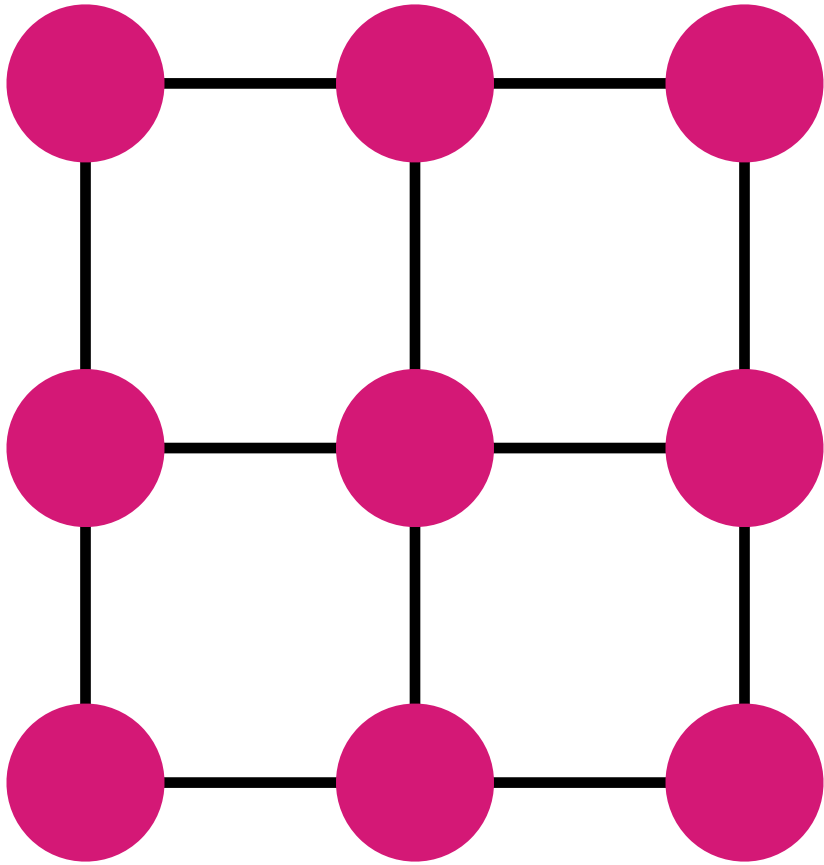
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1	2	1	0
1	1	1	0
1	0	0	1



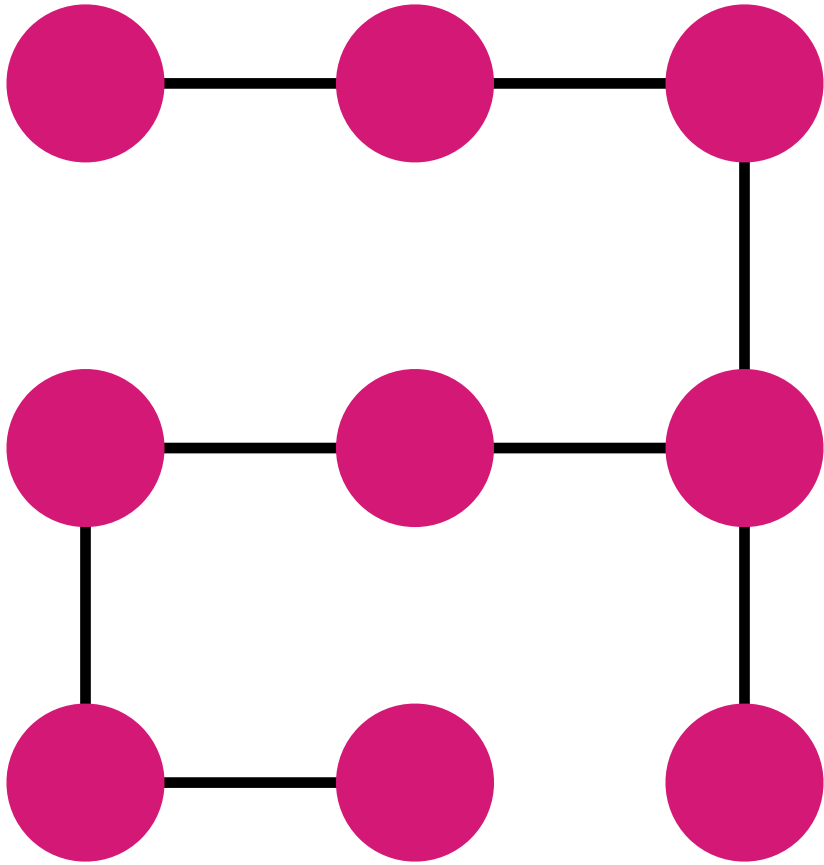
4	1	1	1
1	2	1	0
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1	0	0	1



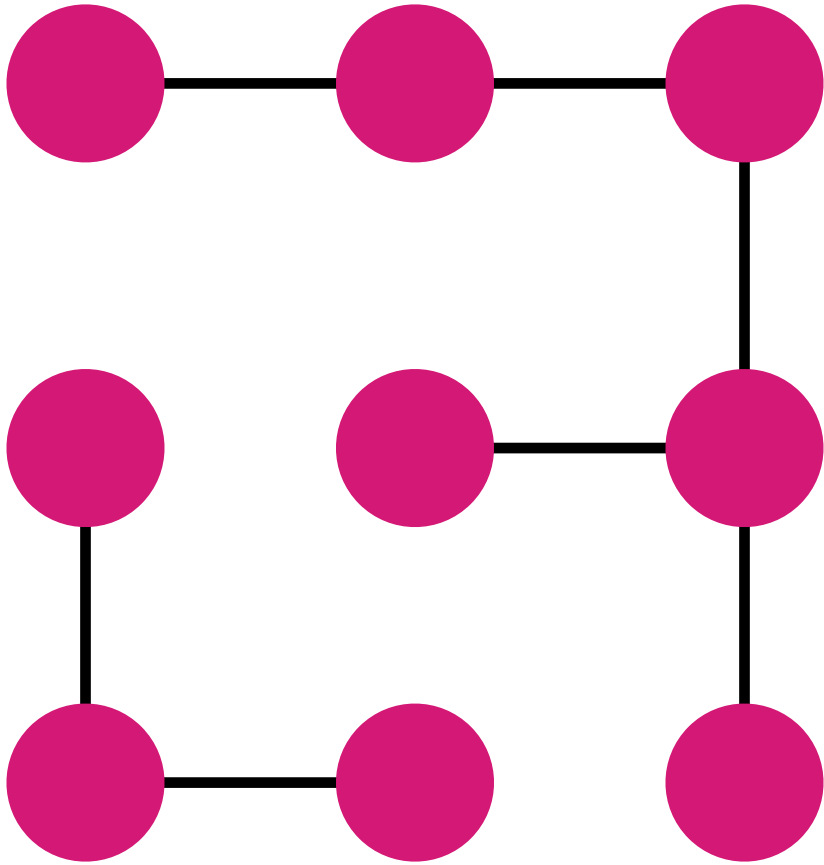
4	1	1	1
1	2	1	0
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1	0	0	1



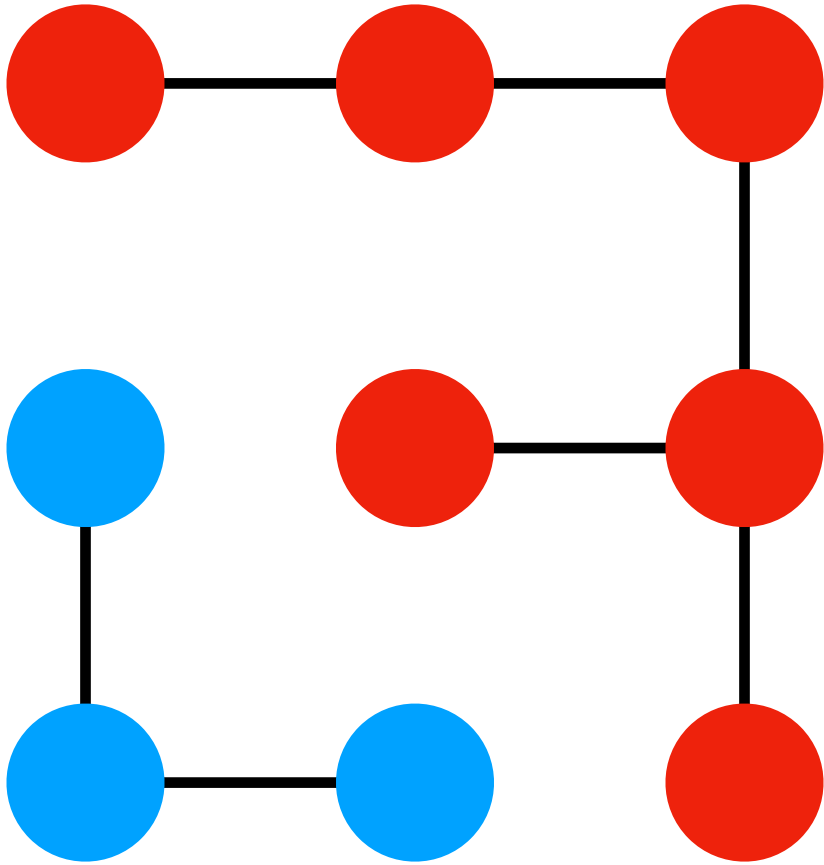
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1	2	1	0
1	1	1	0
1	0	0	1



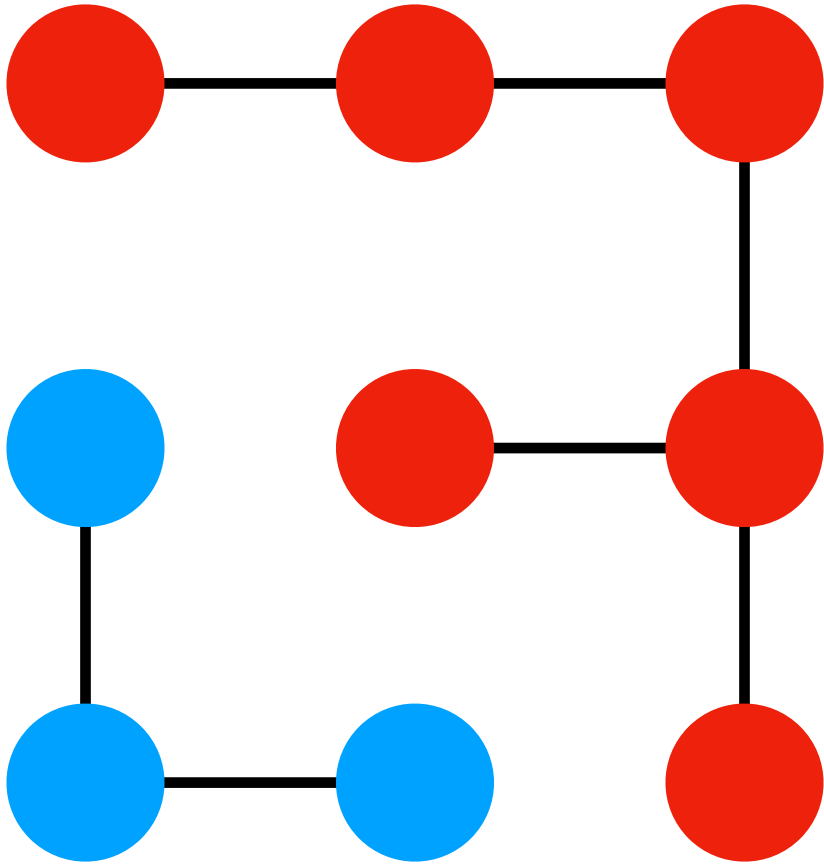
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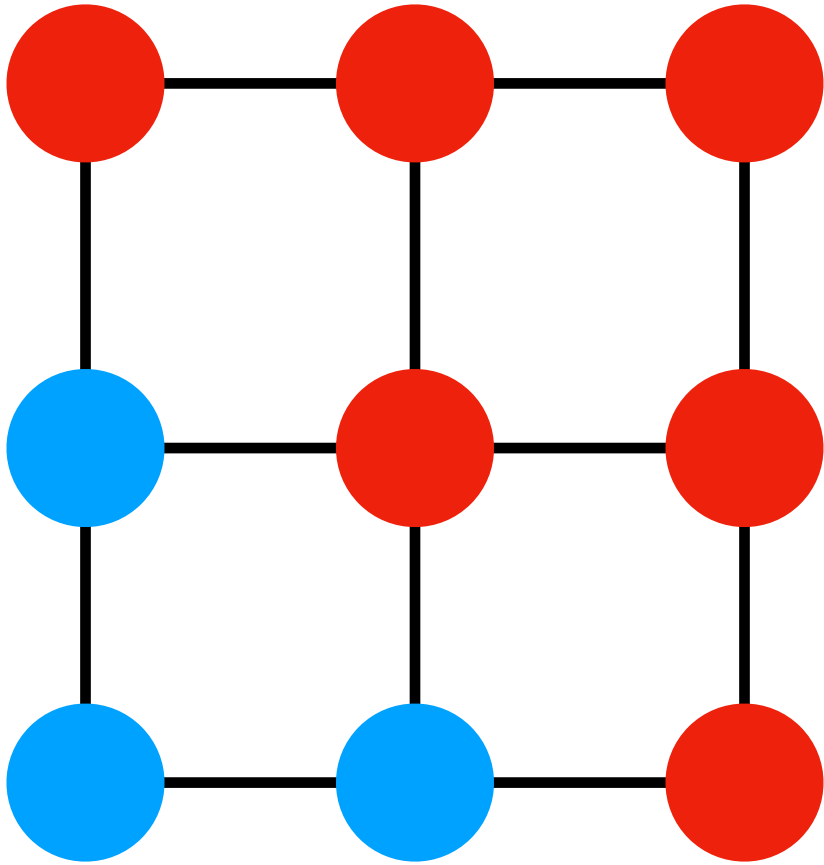
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1	1	1	0
1	0	0	1



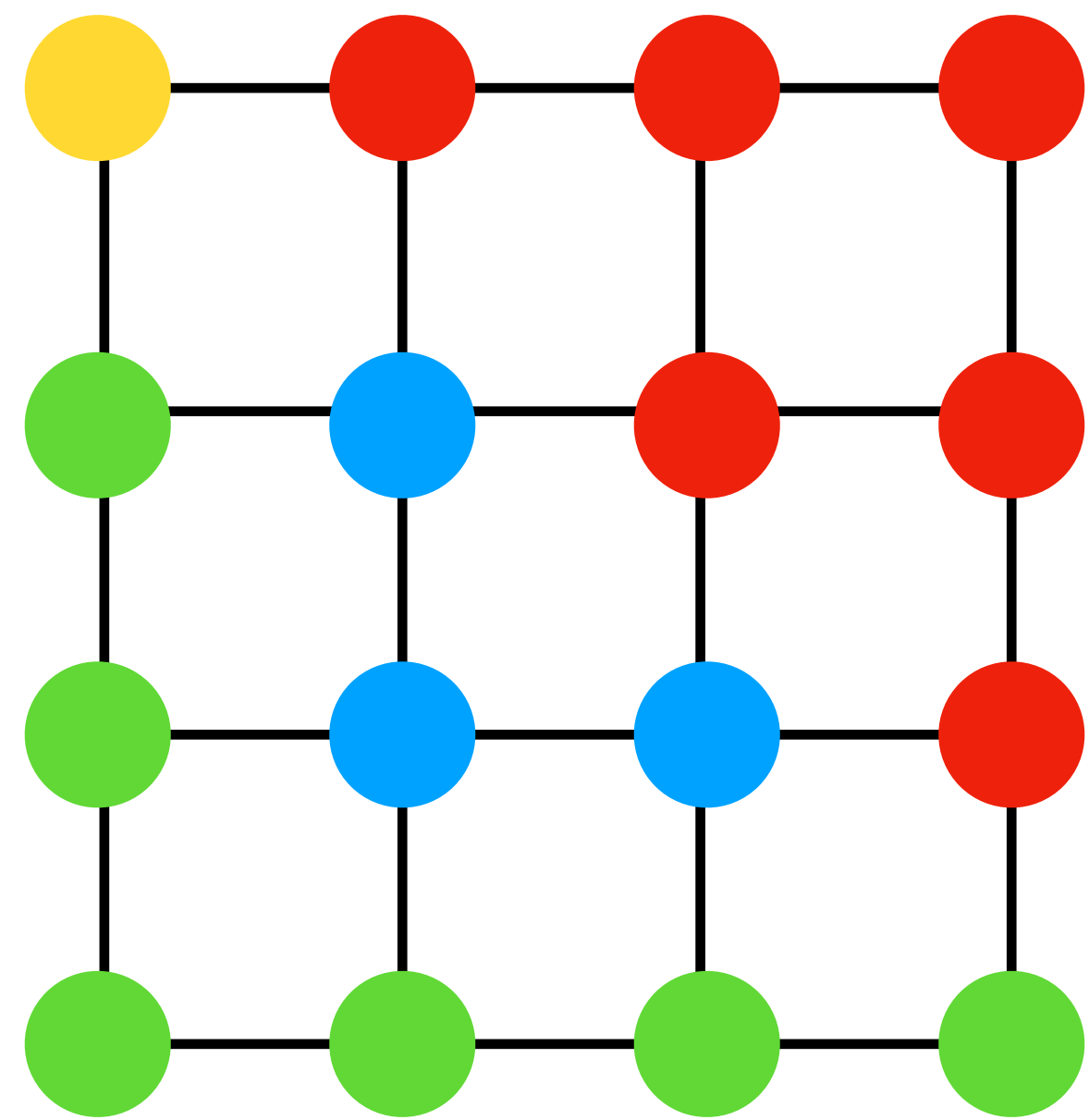
4	1	1	1
1	2	1	0
1	1	1	0
1	0	0	1



4	1	1	1
1	2	1	0
1	1	1	0
1	0	0	1



4	1	1	1
1	2	1	0
1	1	1	0
1	0	0	1



$$S : \mathcal{P} \rightarrow [0,1]$$

$$\mathbf{P}(P^*) = \frac{S(P^*)}{\sum_{p \in \mathcal{P}} S(p)}$$

$$\frac{\mathbf{P}(P^*)}{\mathbf{P}(P)} = \frac{\frac{S(P^*)}{\sum_{p \in \mathcal{P}} S(p)}}{\frac{S(P)}{\sum_{p \in \mathcal{P}} S(p)}}$$

$$\begin{aligned}
 \frac{\mathbf{P}(P^*)}{\mathbf{P}(P)} &= \frac{\frac{S(P^*)}{\cancel{\sum_{p \in \mathcal{P}} S(p)}}}{\frac{S(P)}{\cancel{\sum_{p \in \mathcal{P}} S(p)}}} \\
 &= \frac{S(P^*)}{S(P)}
 \end{aligned}$$

$$\alpha = \min \left(\frac{S(P^*)}{S(P)}, 1 \right)$$

$$\beta \in [0, 1]$$

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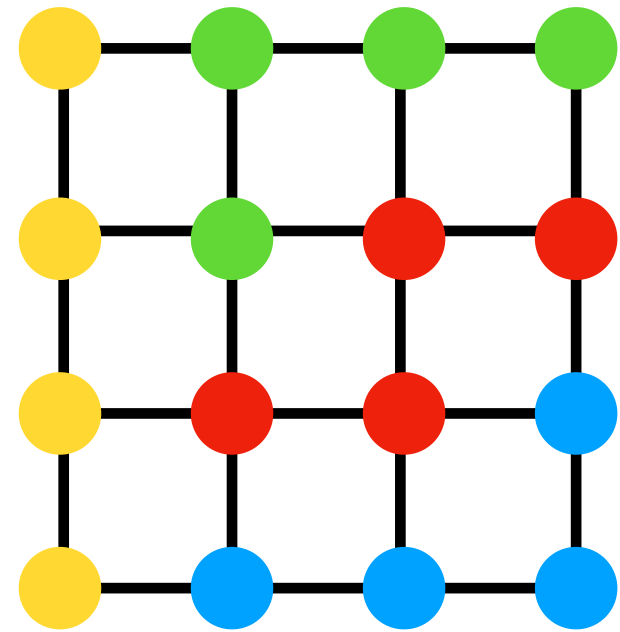
$$\beta \in [0, 1]$$

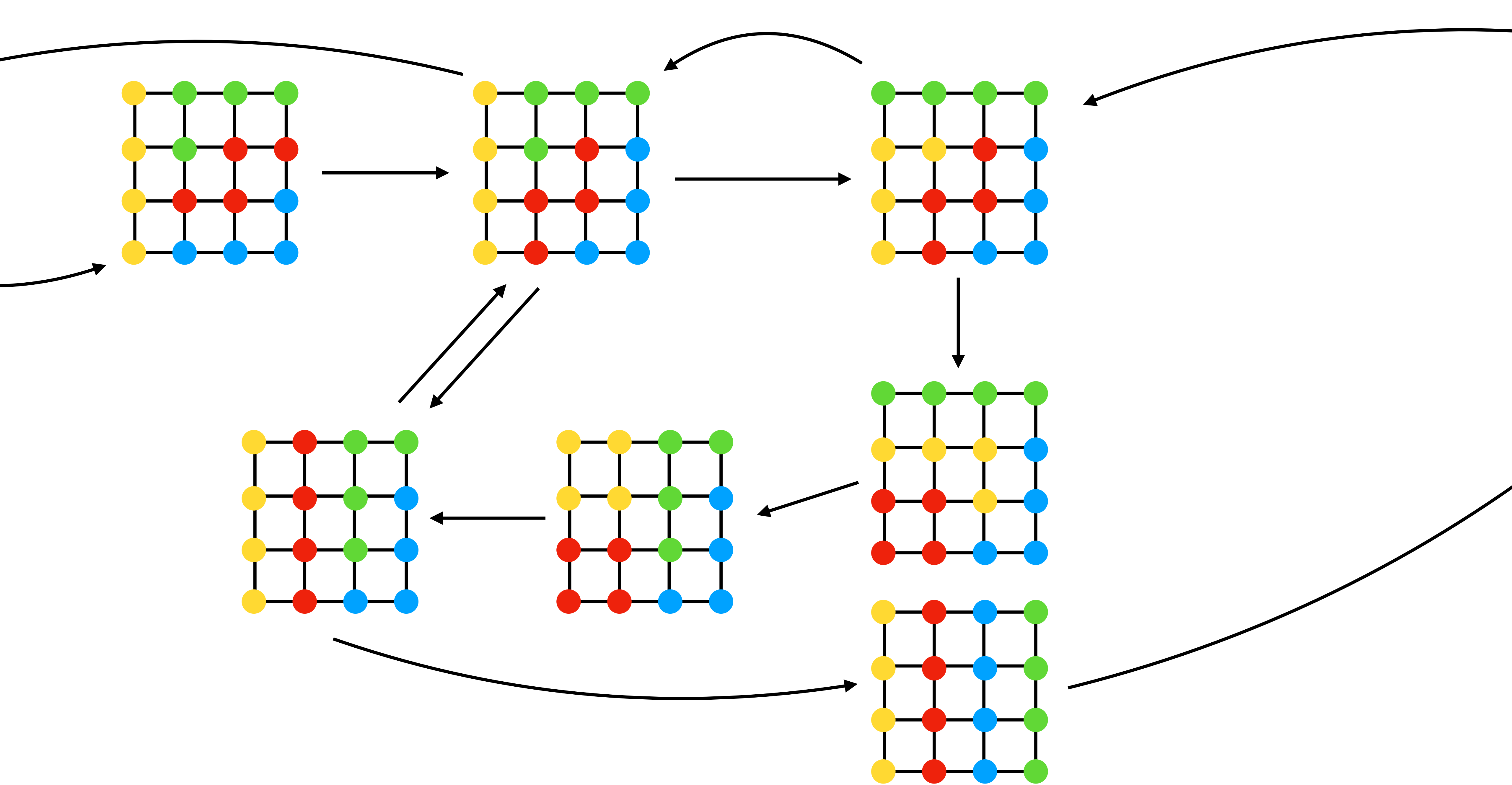


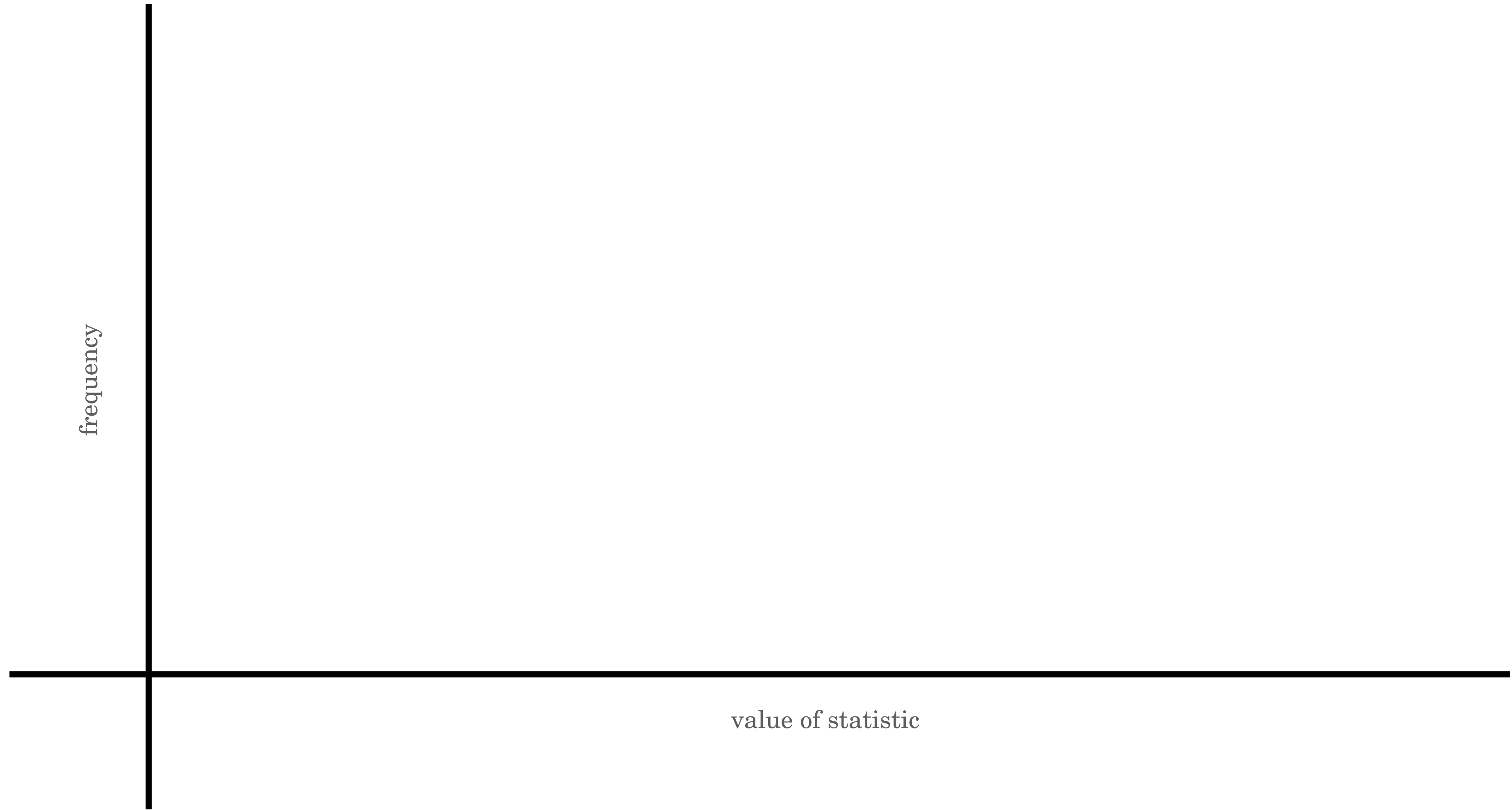
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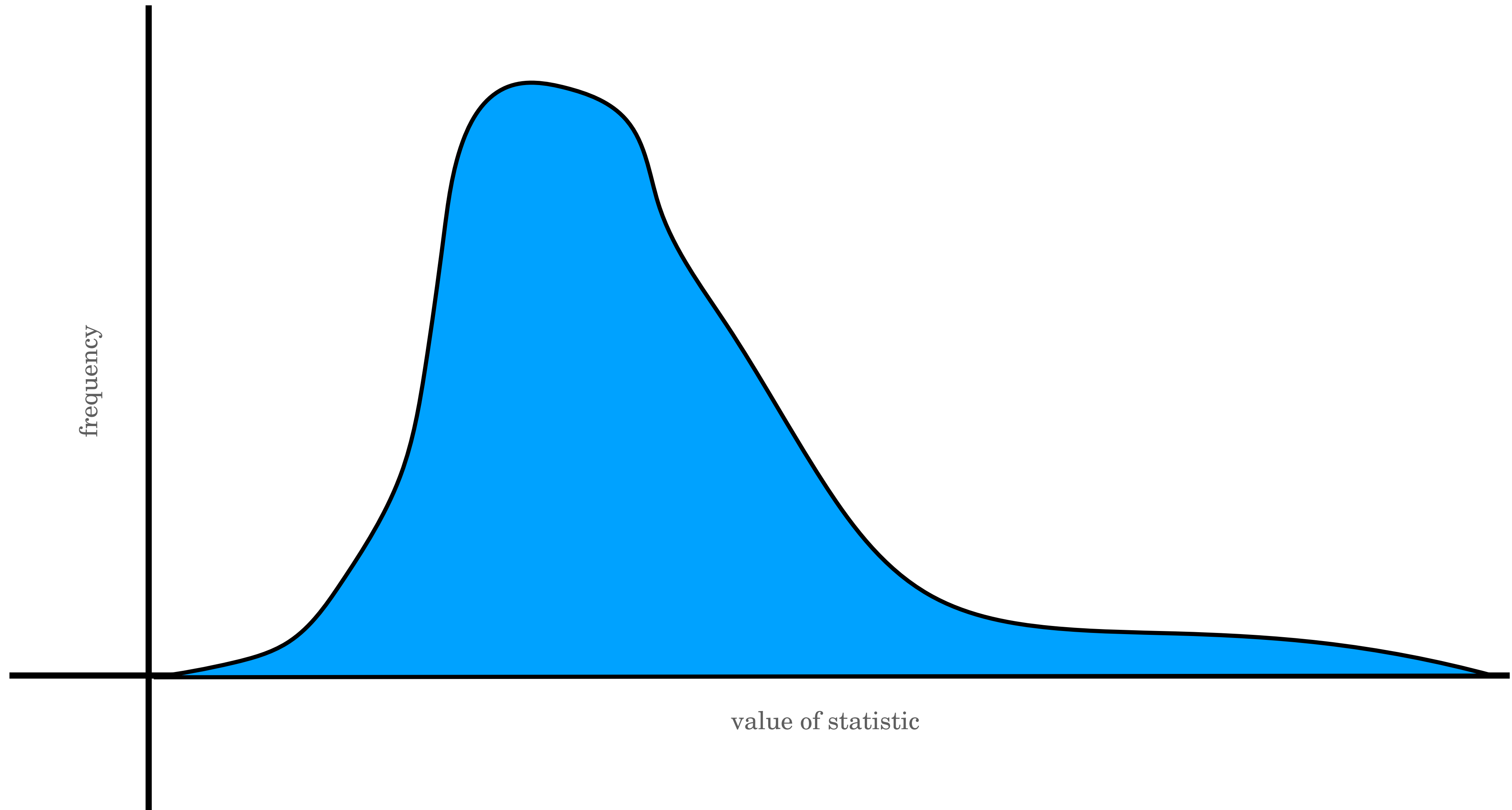
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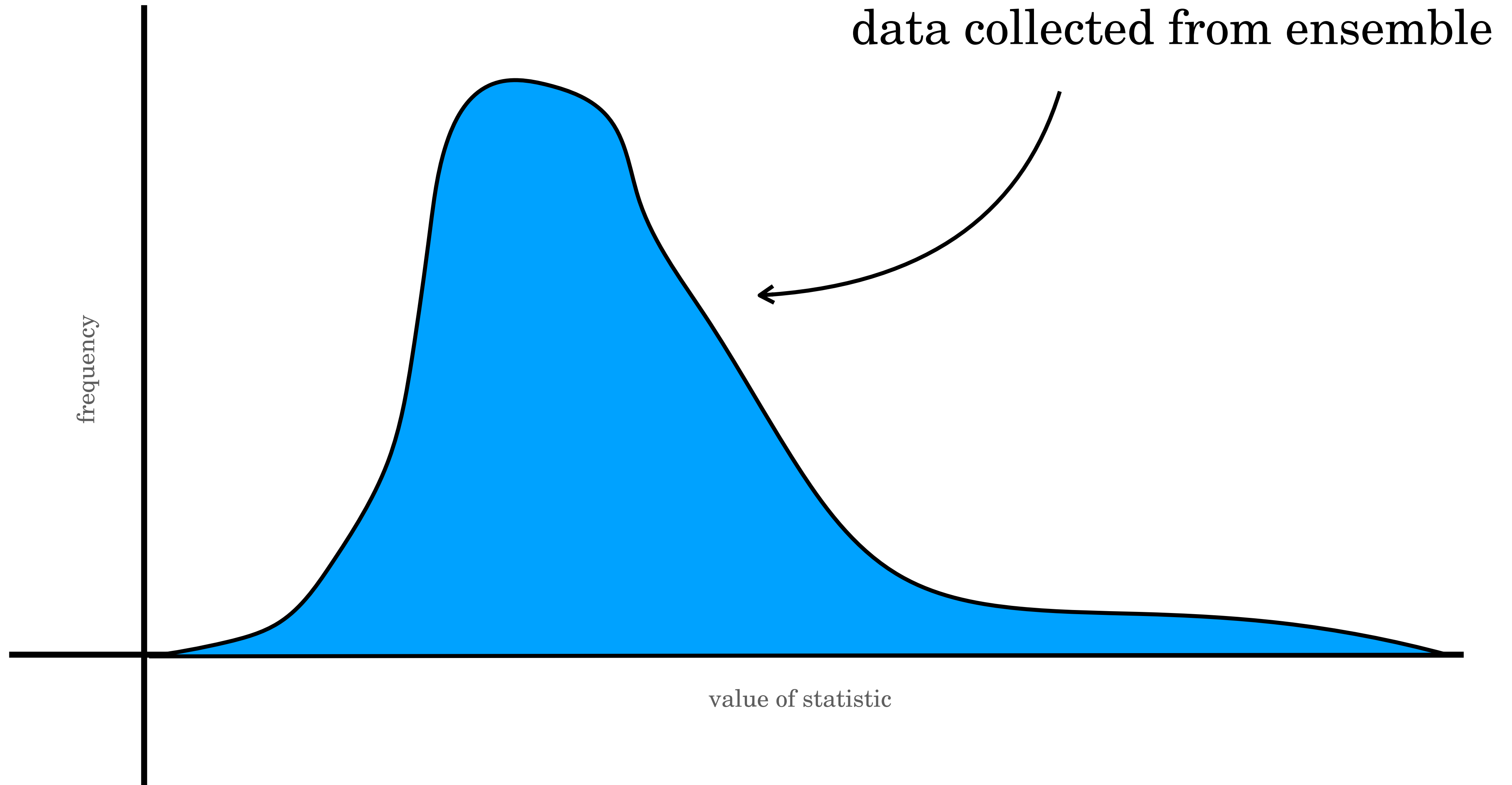


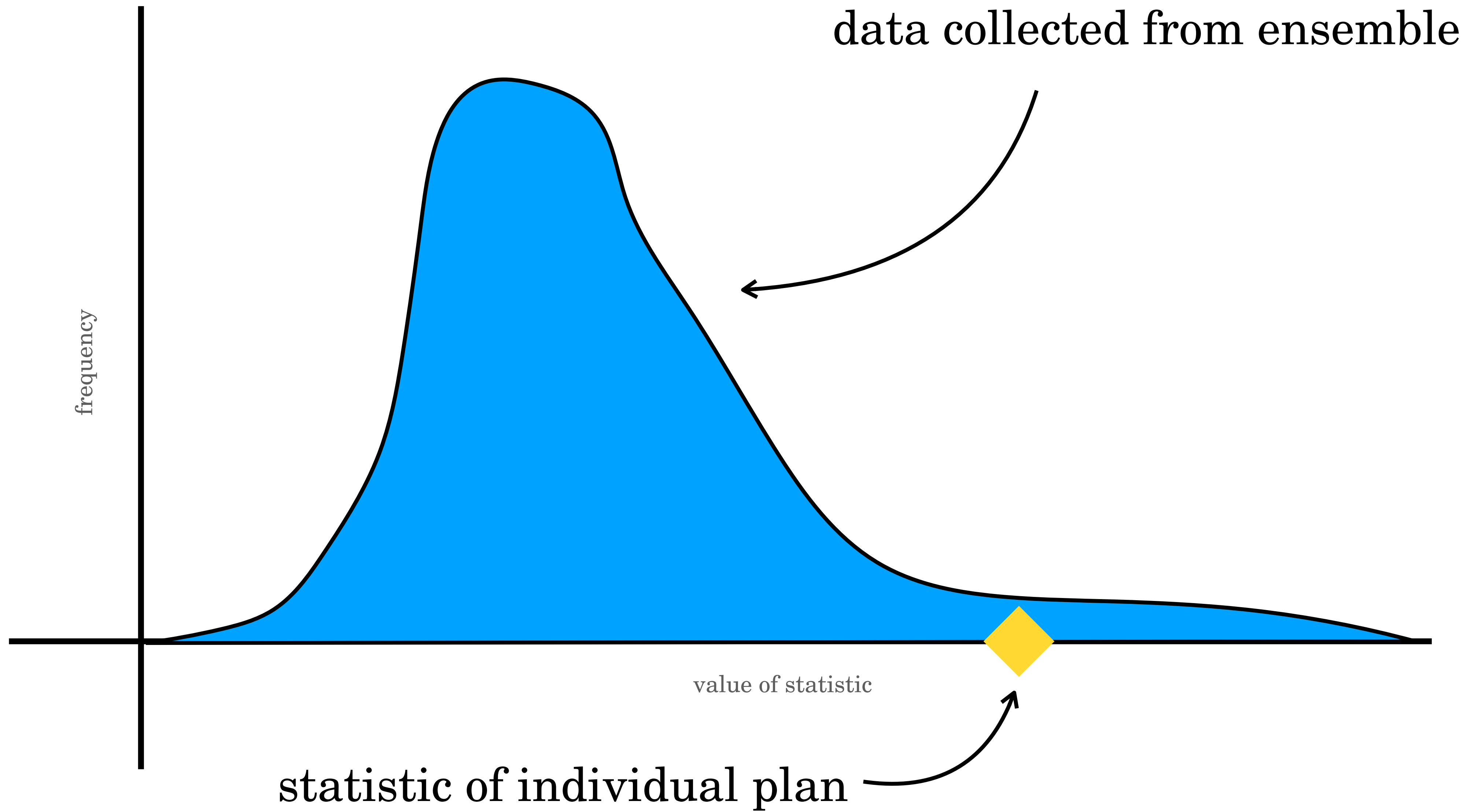


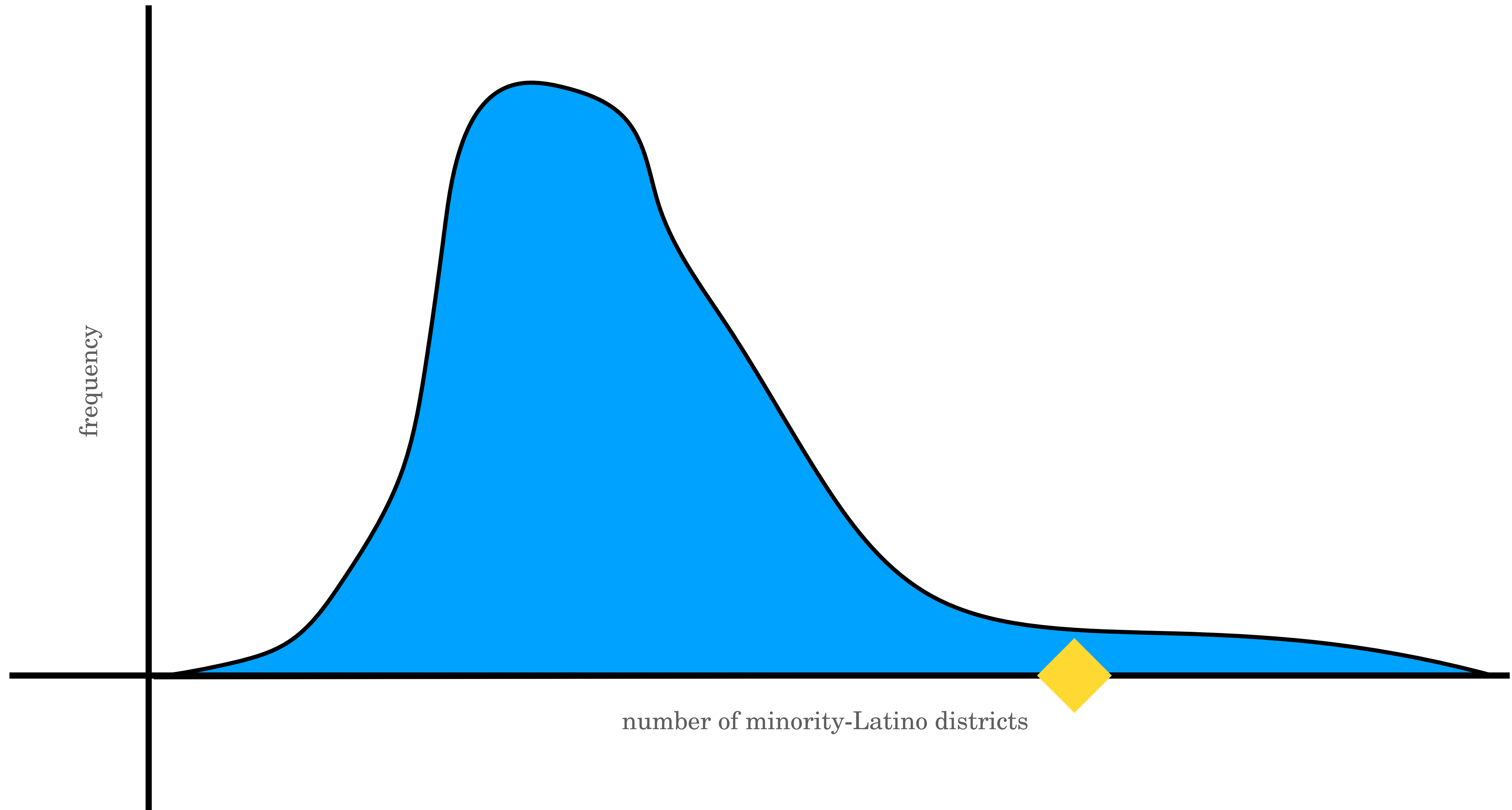








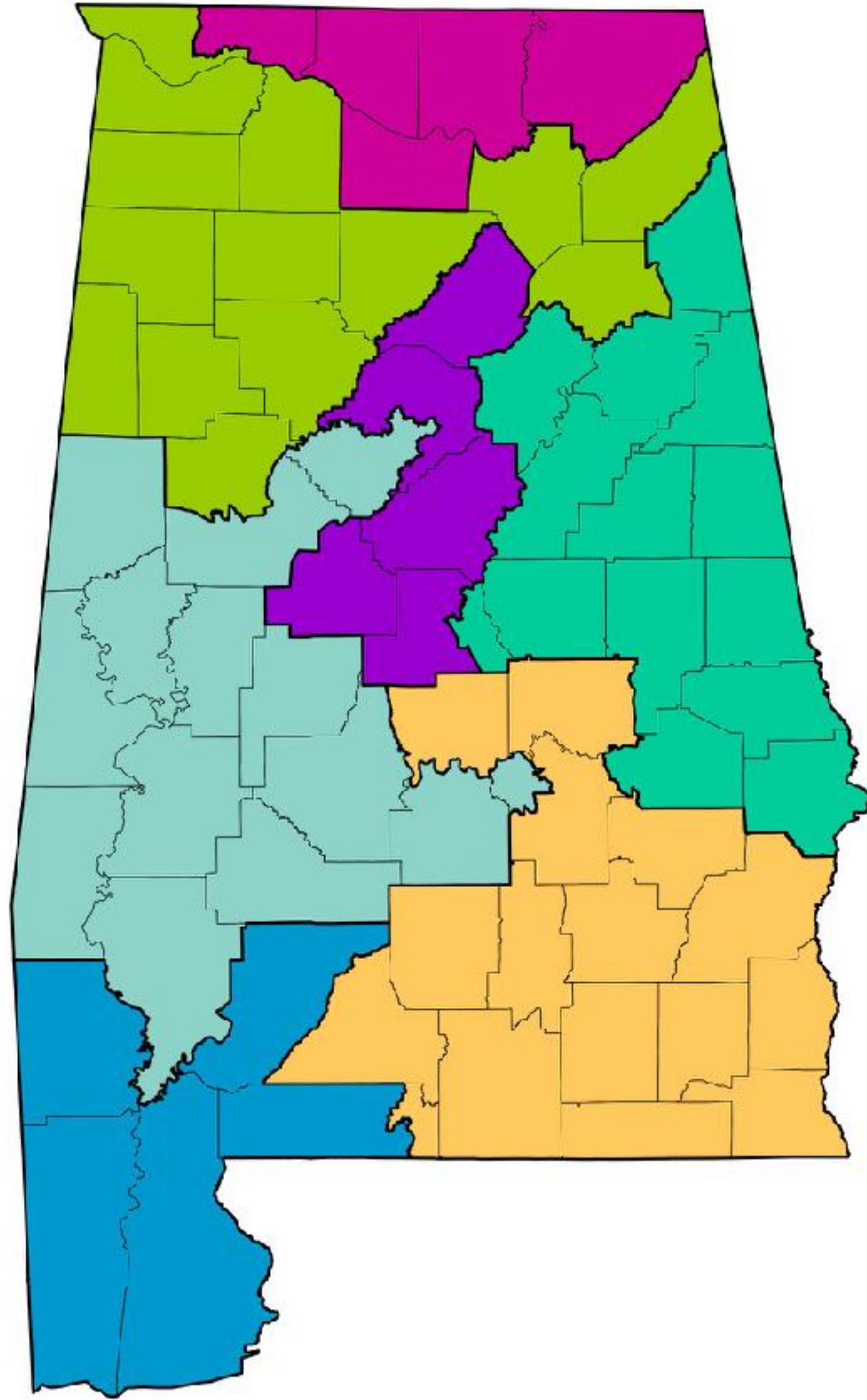


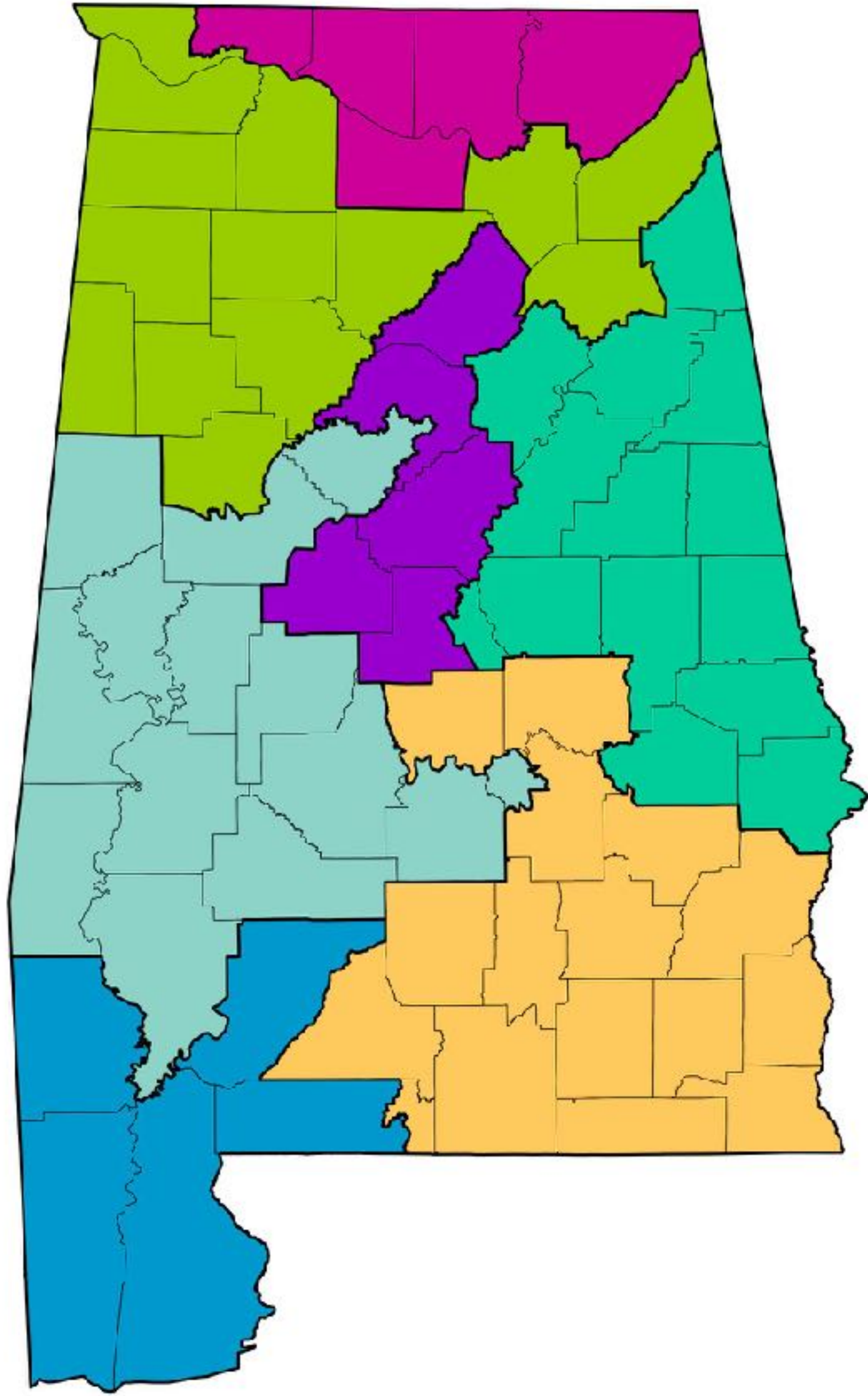


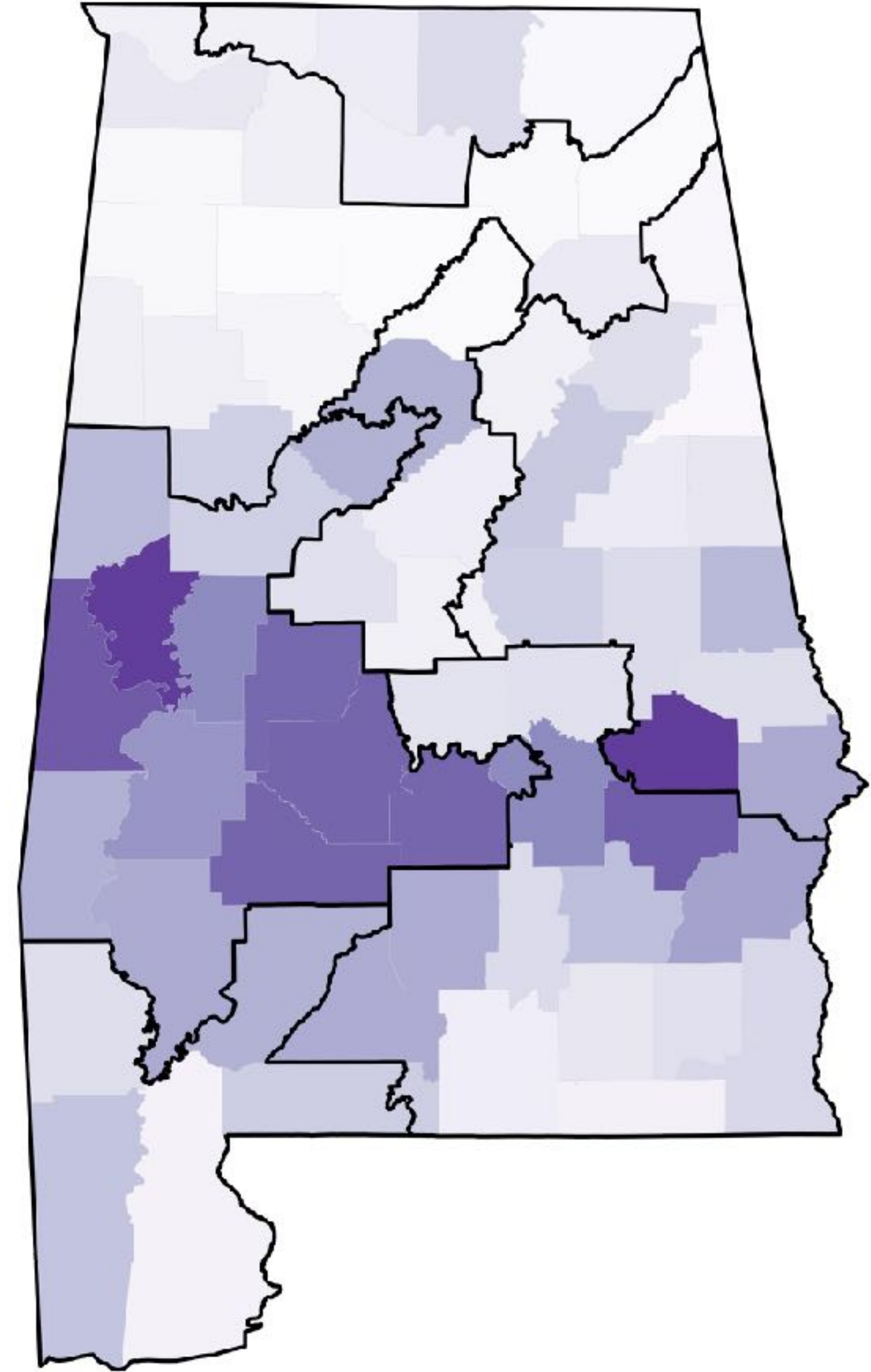
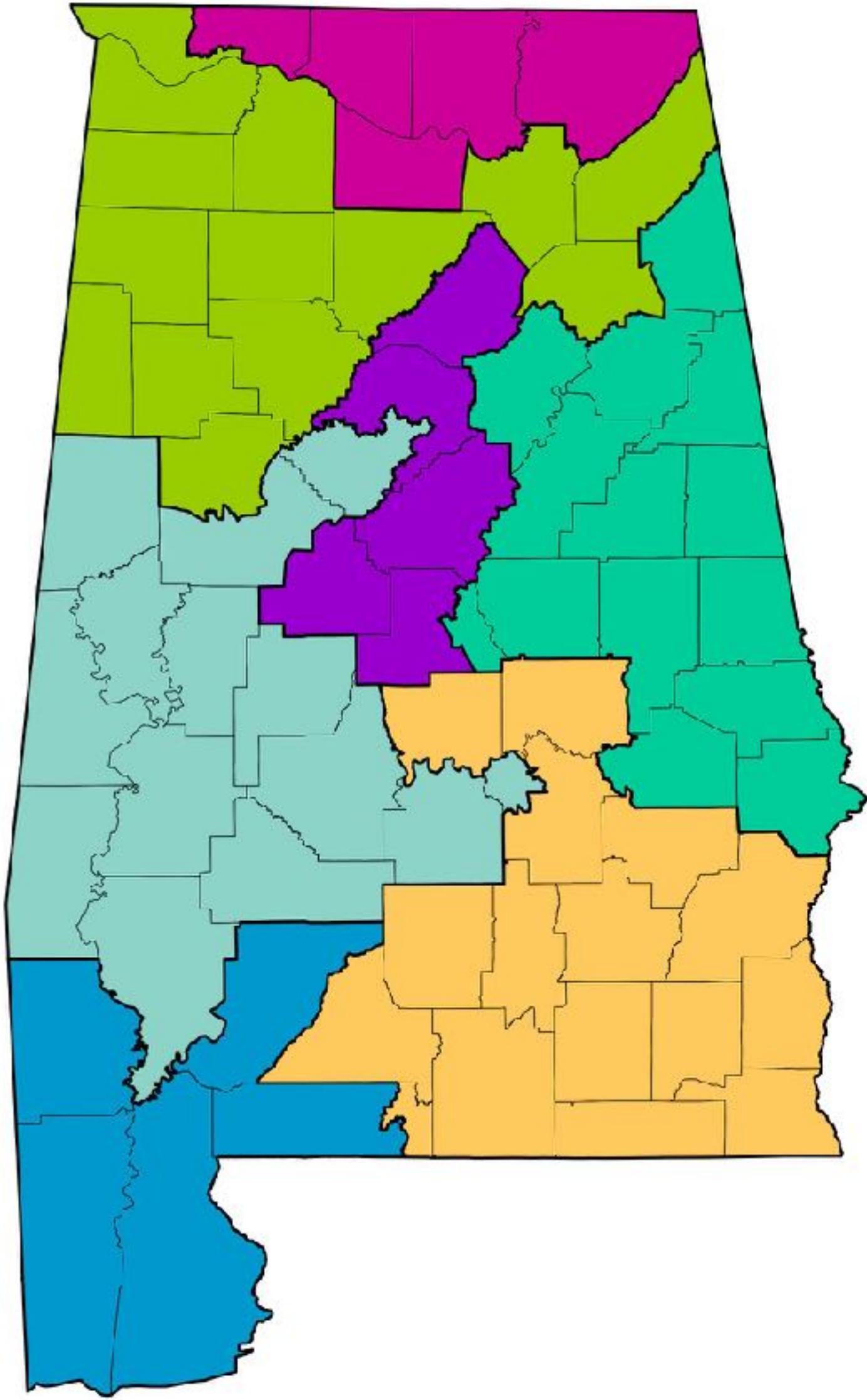
GerryChain (and GerryTools)

applying this technique to redistricting is fairly revolutionary.

3. putting things into practice







§2 VRA: “You can’t abridge someone’s right to vote **based on race.**”

Milligan v. Merrill

Milligan v. Merrill

Gingles test

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is the minority group...

Gingles test

is the minority group...

1. “sufficiently large and geographically compact”

Gingles test

is the minority group...

1. “sufficiently large and geographically compact”
2. politically cohesive

Gingles test

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3. always out-voted by White voters

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The Legislature enjoys broad discretion and may consider a wide range of remedial plans. As the Legislature considers such plans, it should be mindful of the practical reality, based on the ample evidence of intensely racially polarized voting adduced during the preliminary injunction proceedings, that any remedial plan will need to include two districts in which Black voters either comprise a voting-age majority or something quite close to it.

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The District Court's order would require heroic efforts by those state and local authorities in the next few weeks—and even heroic efforts likely would not be enough to avoid chaos and confusion.

For those and other reasons, the State says that any judicial order requiring the State to redraw its congressional district lines should not apply to the imminent 2022 elections that begin next month.

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with totally “neutral” techniques, you
can’t find majority-Black districts.

“race-blind baseline”

Milligan v. Merrill

Merrill v. Milligan

the math of redistricting provides *tools*, not *solutions*.

we have an opportunity.

we have a *responsibility*.