Infinite Mancala

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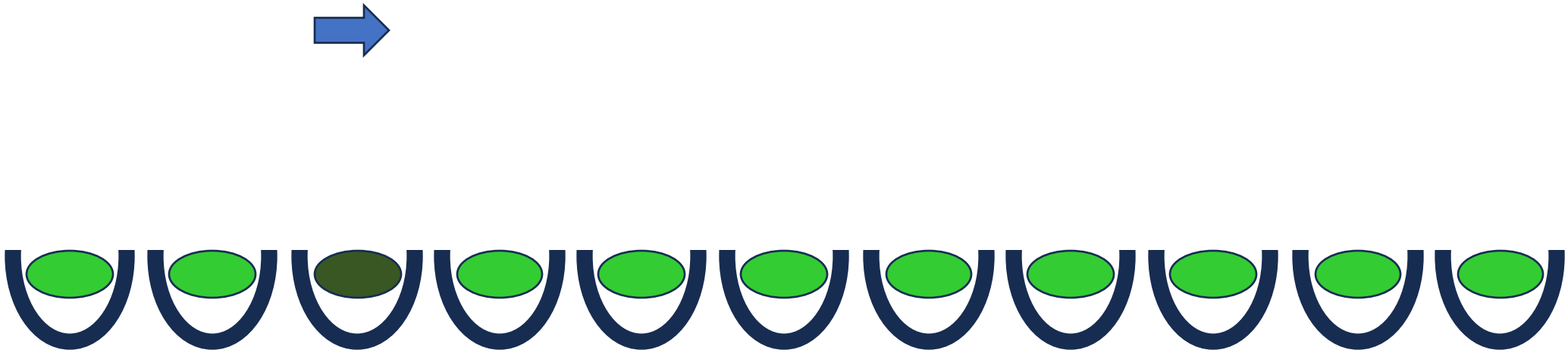

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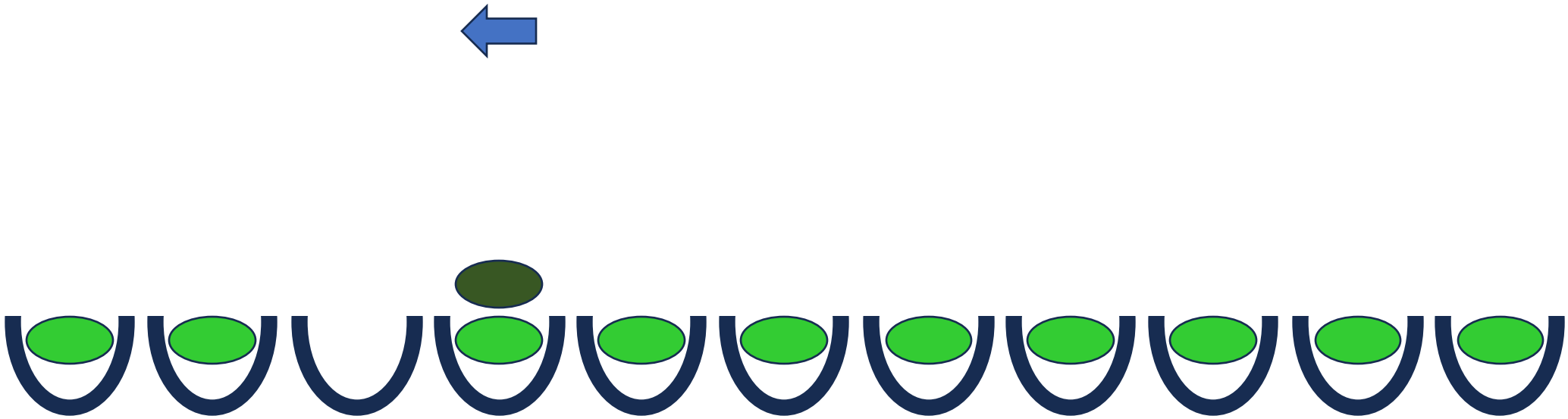

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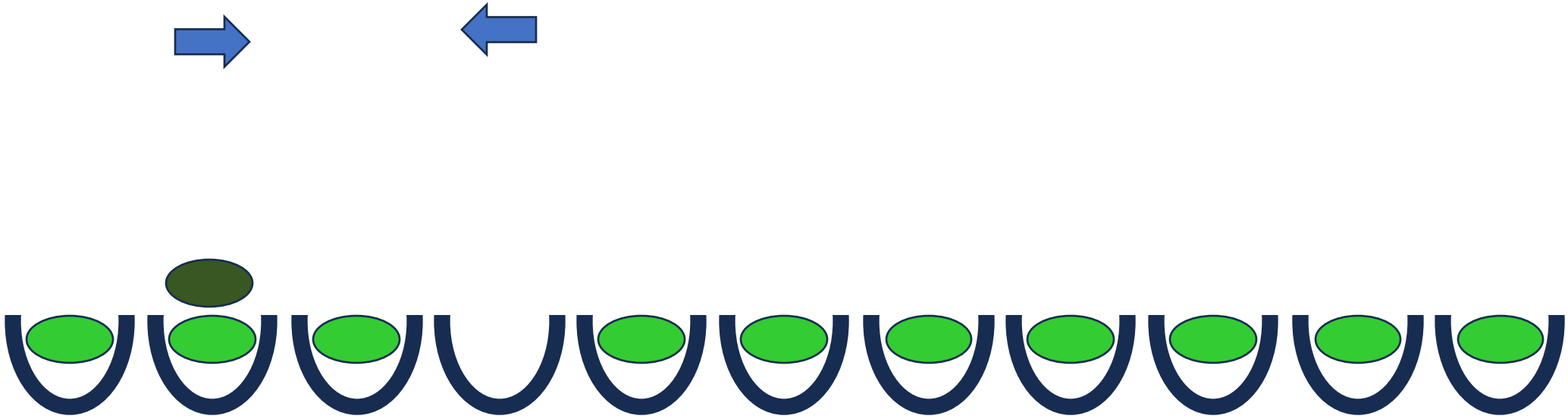

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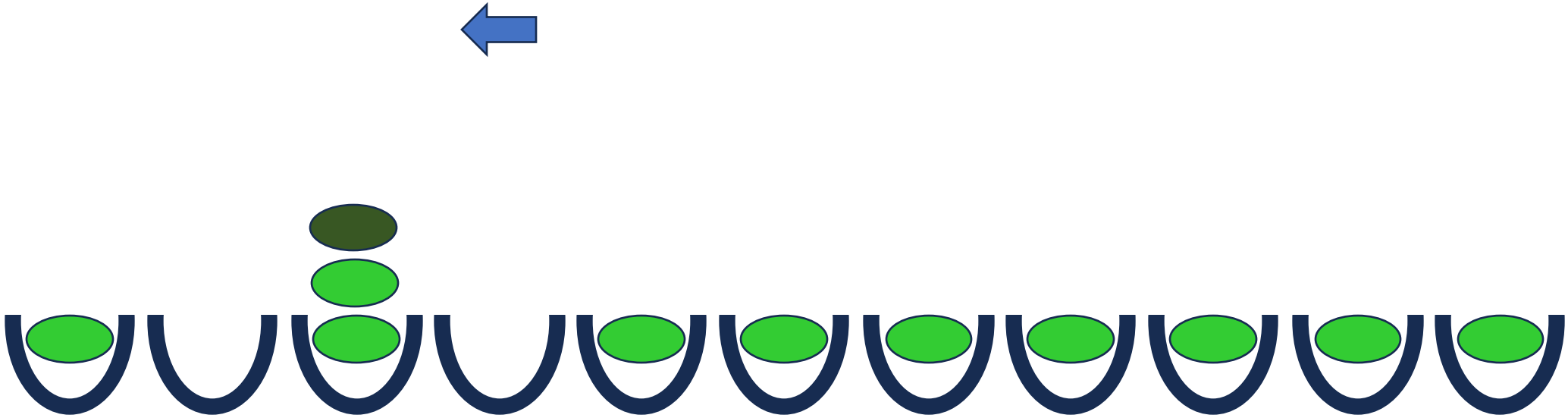

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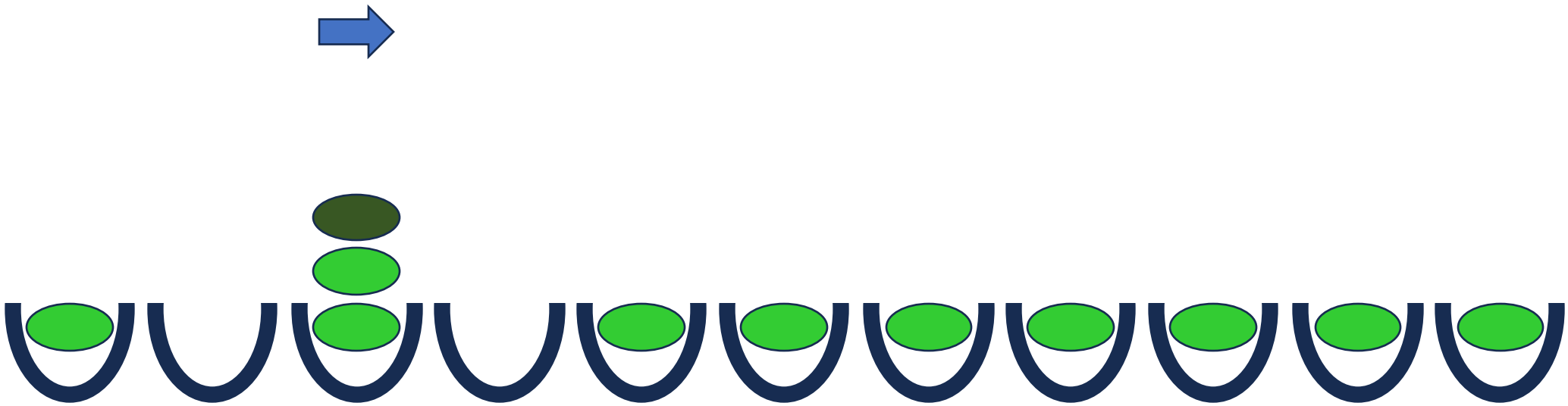

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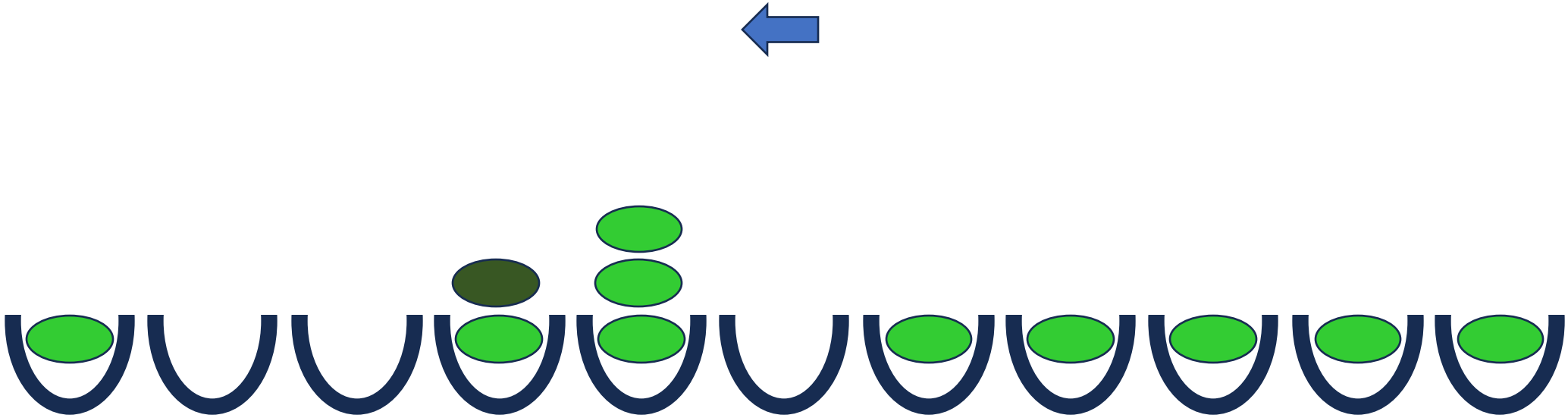

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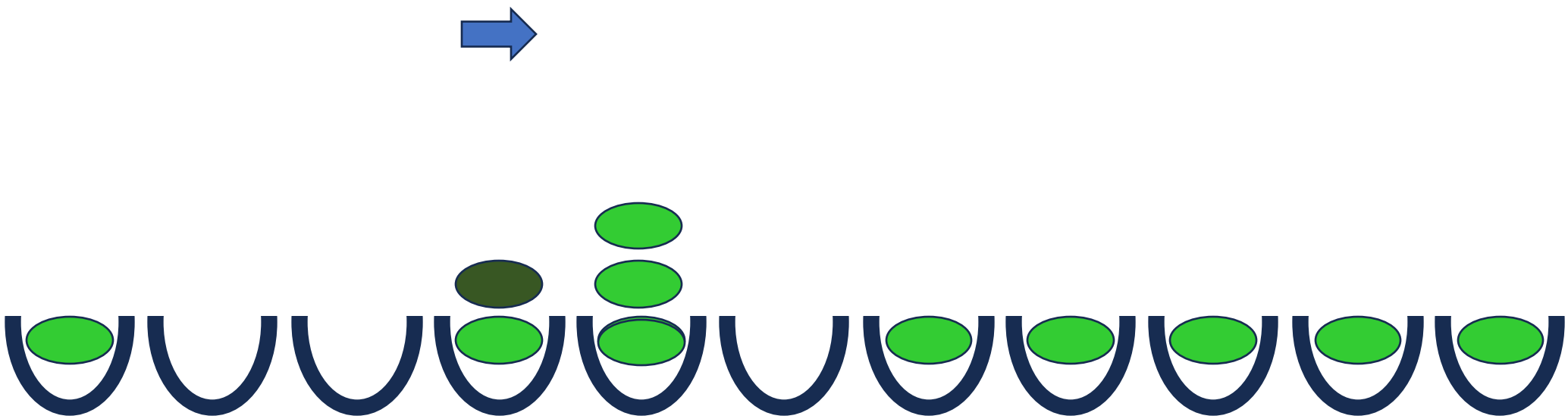

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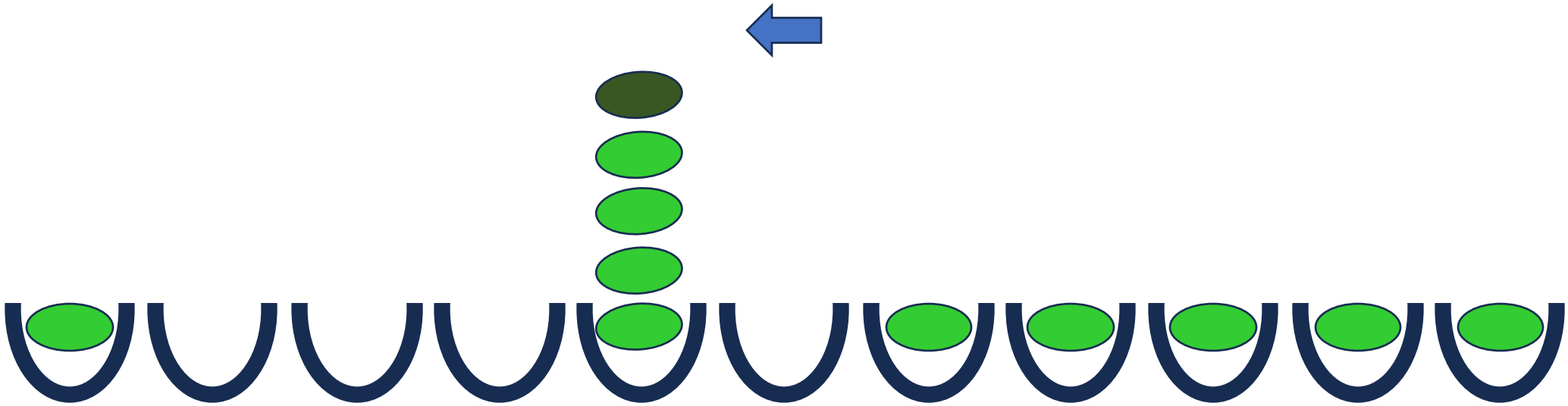

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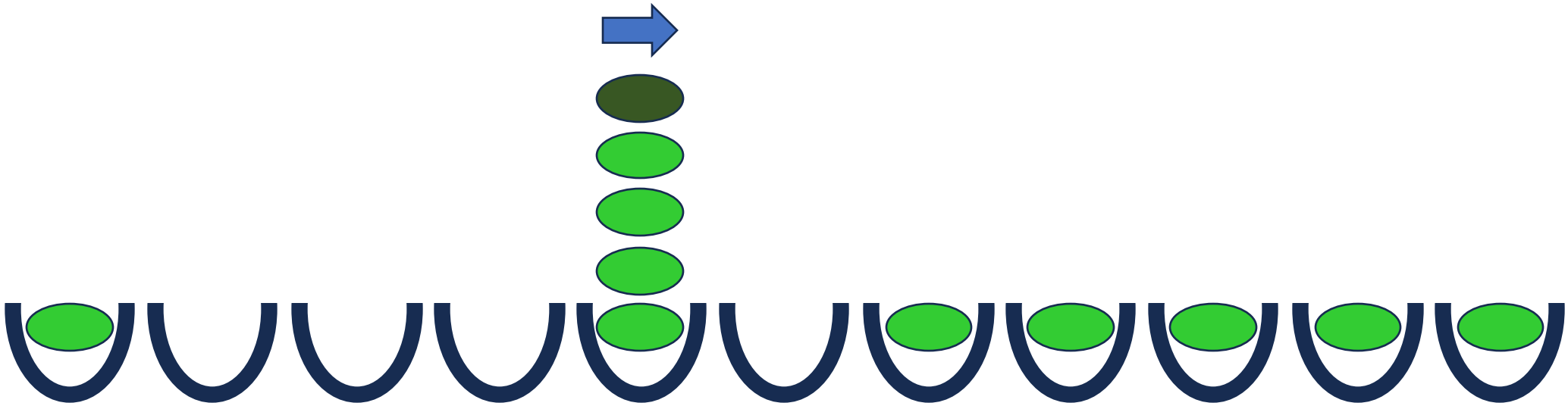

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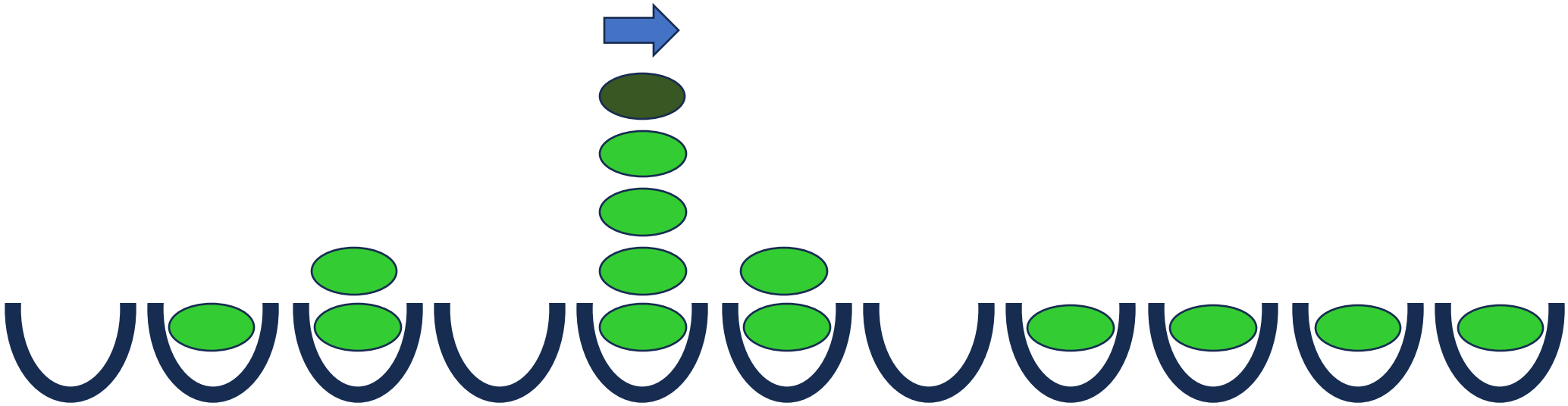

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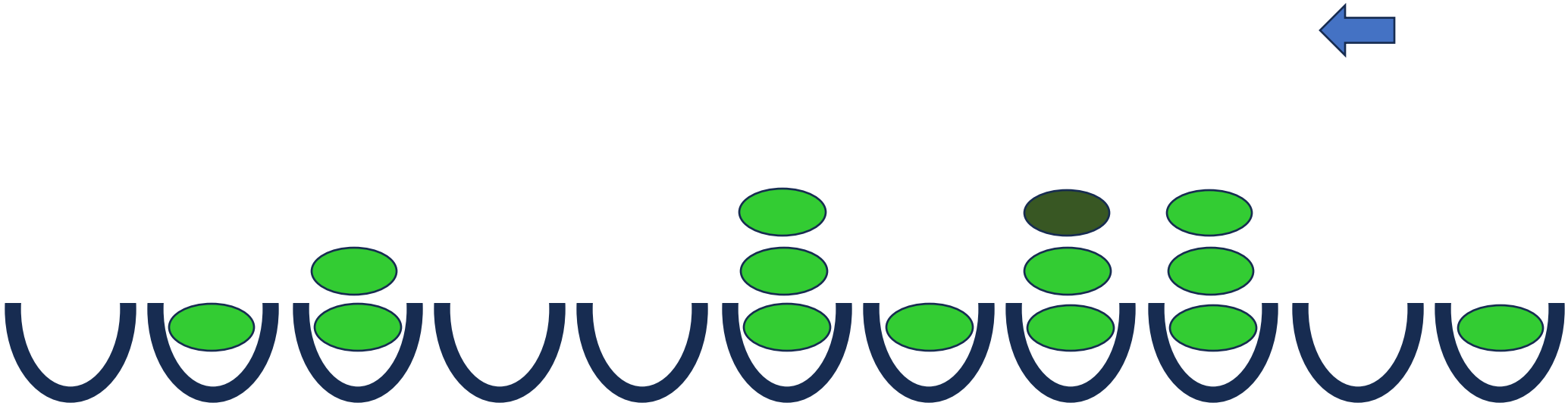

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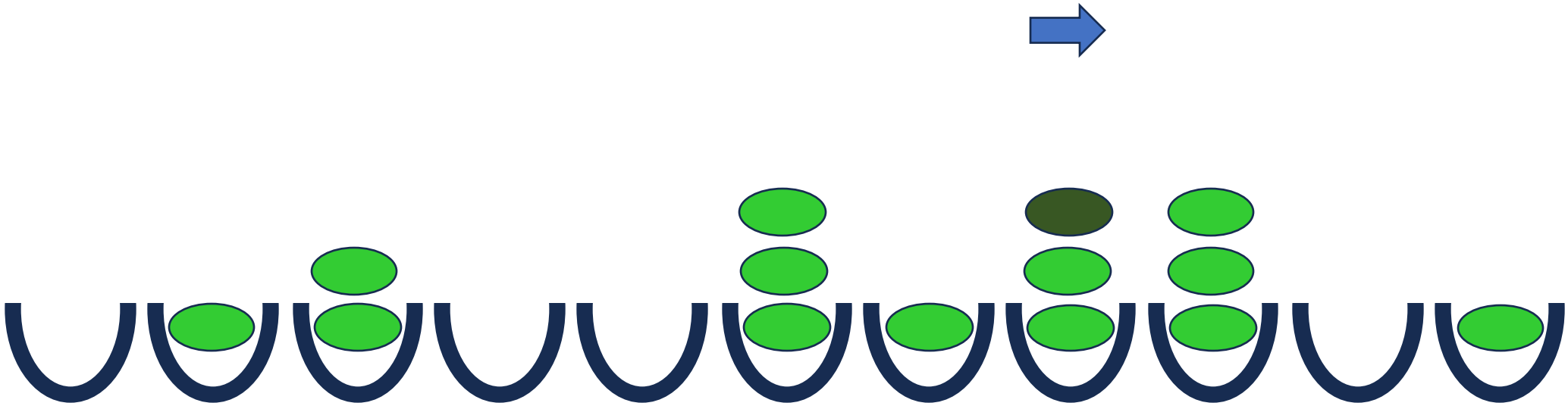

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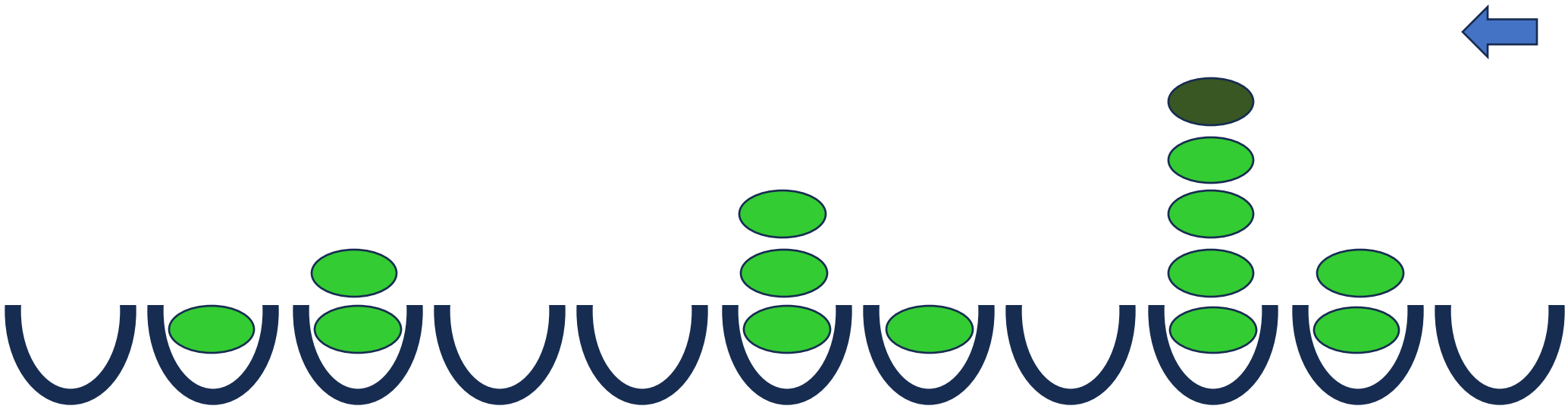

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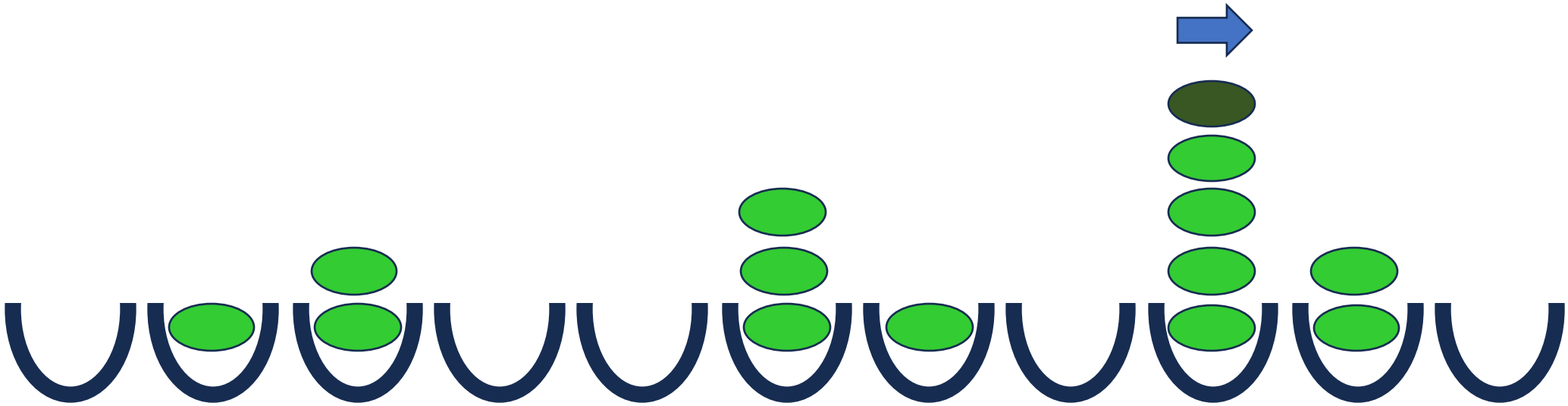

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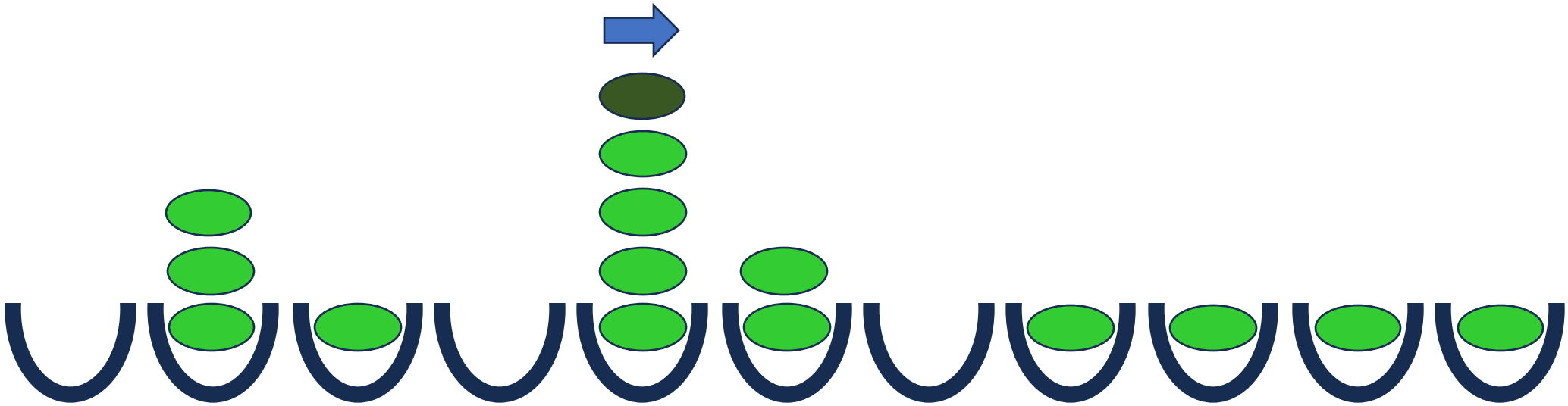

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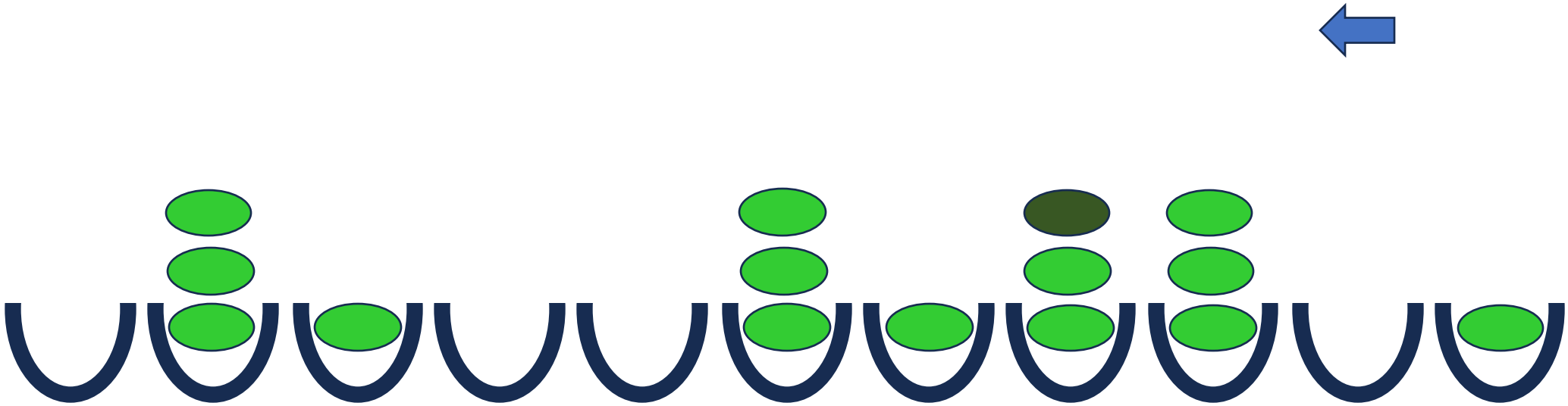

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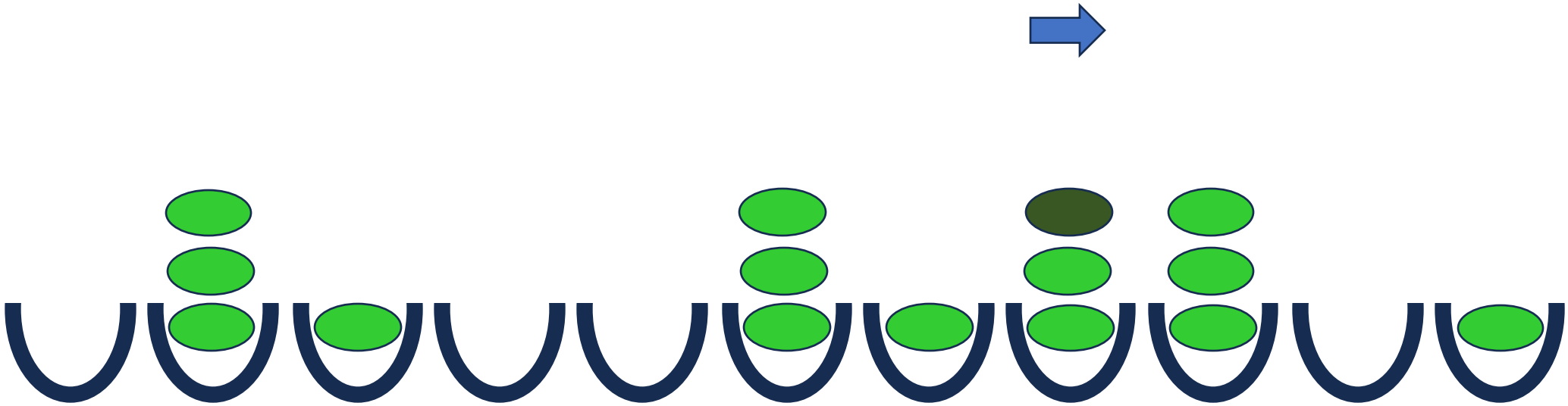

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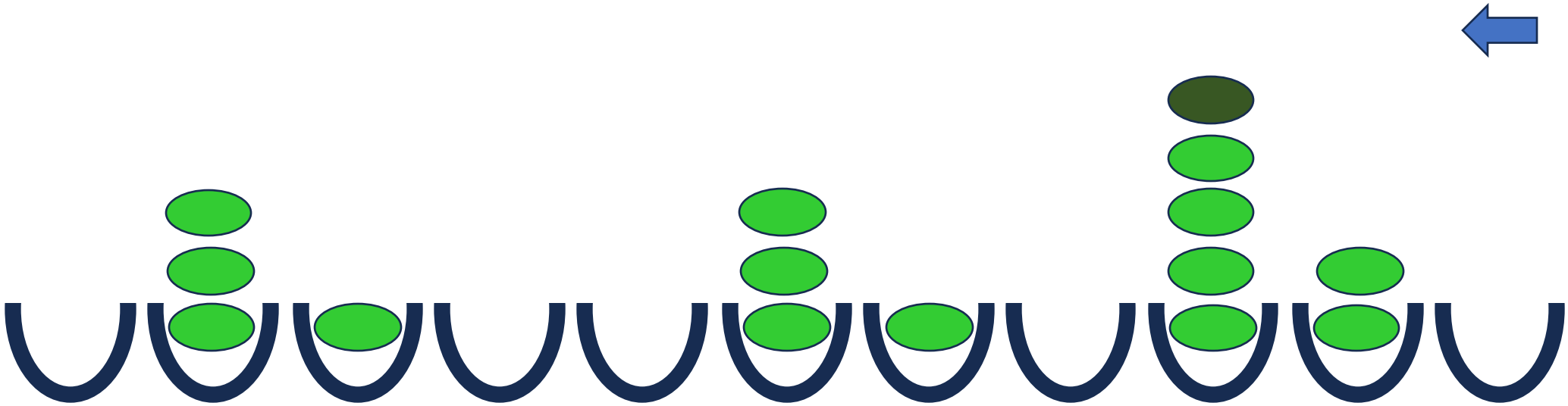

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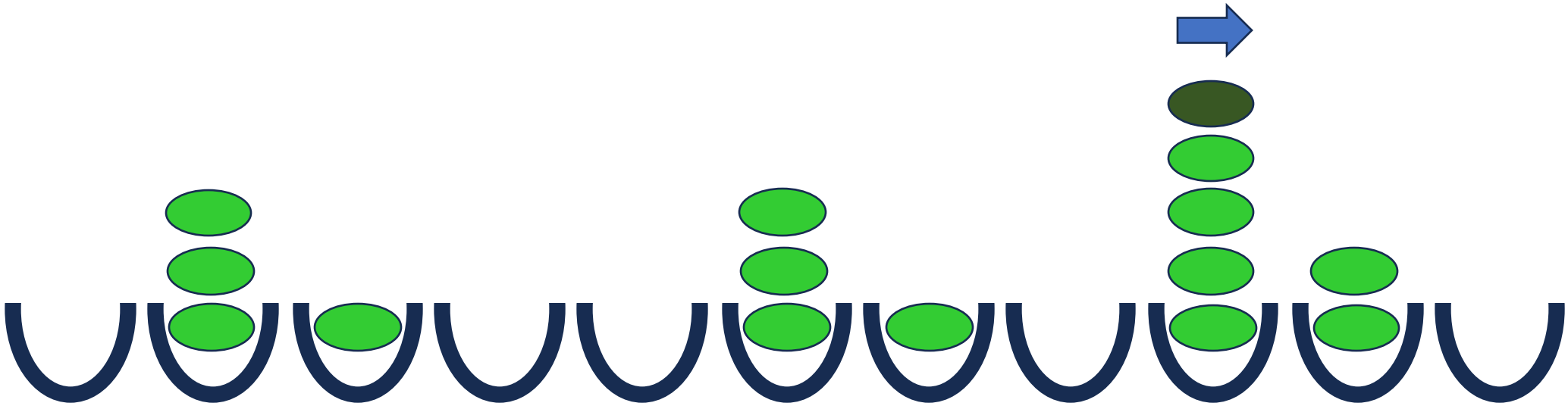

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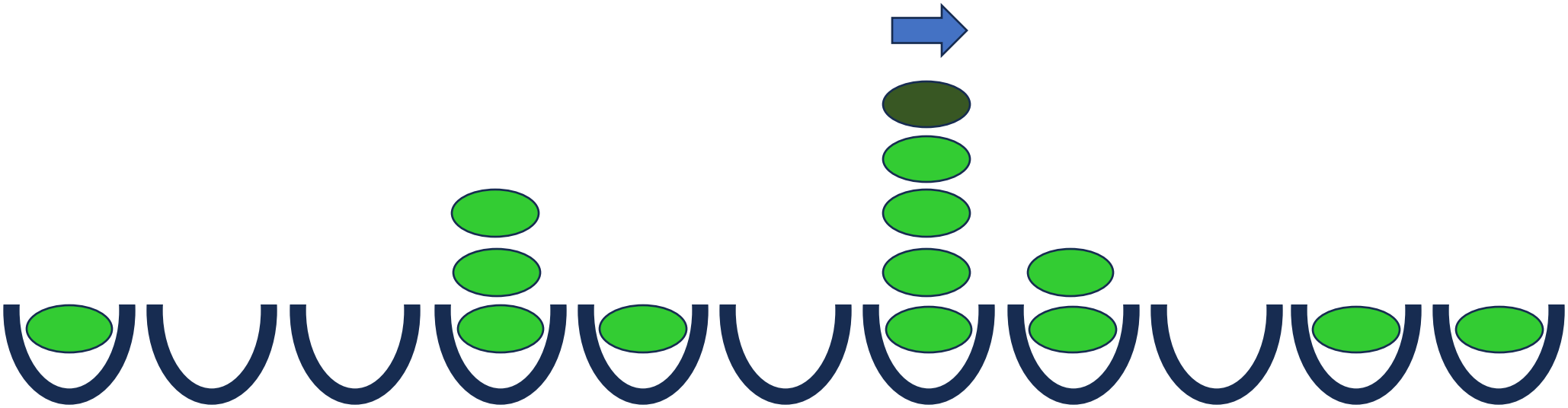

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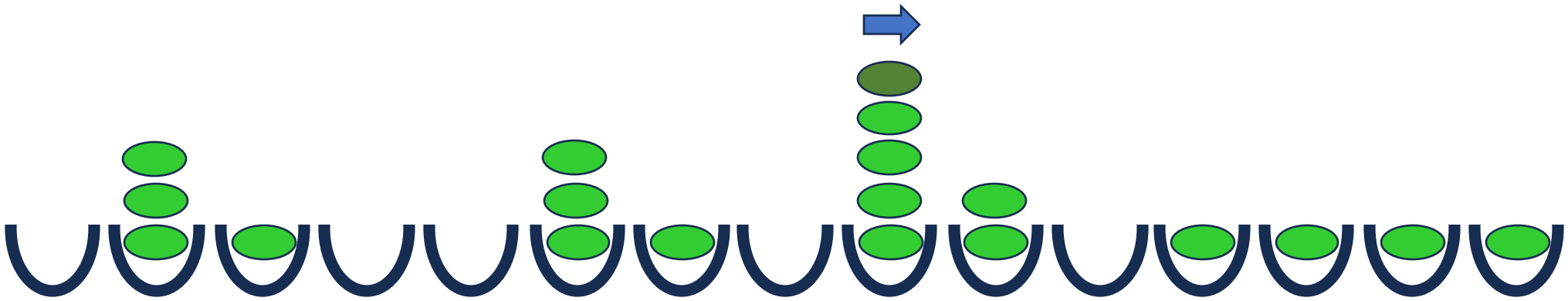
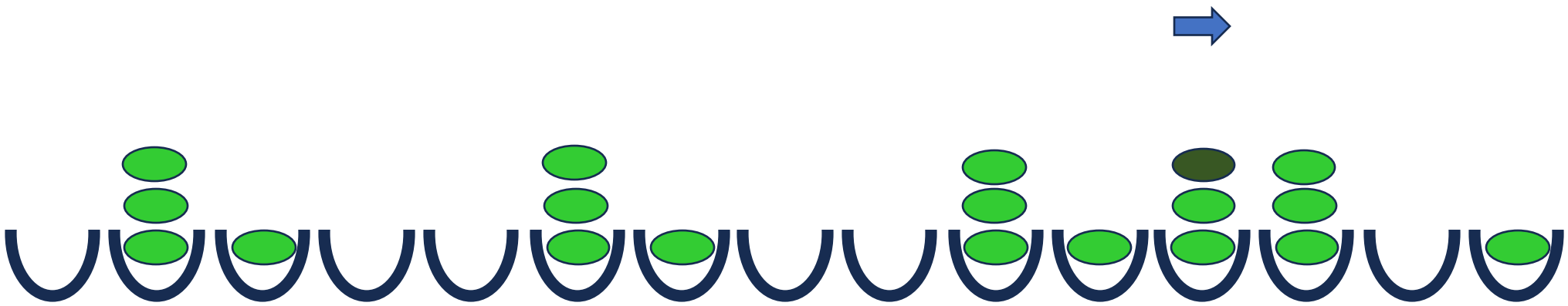


Infinite Mancala

Infinite Mancala



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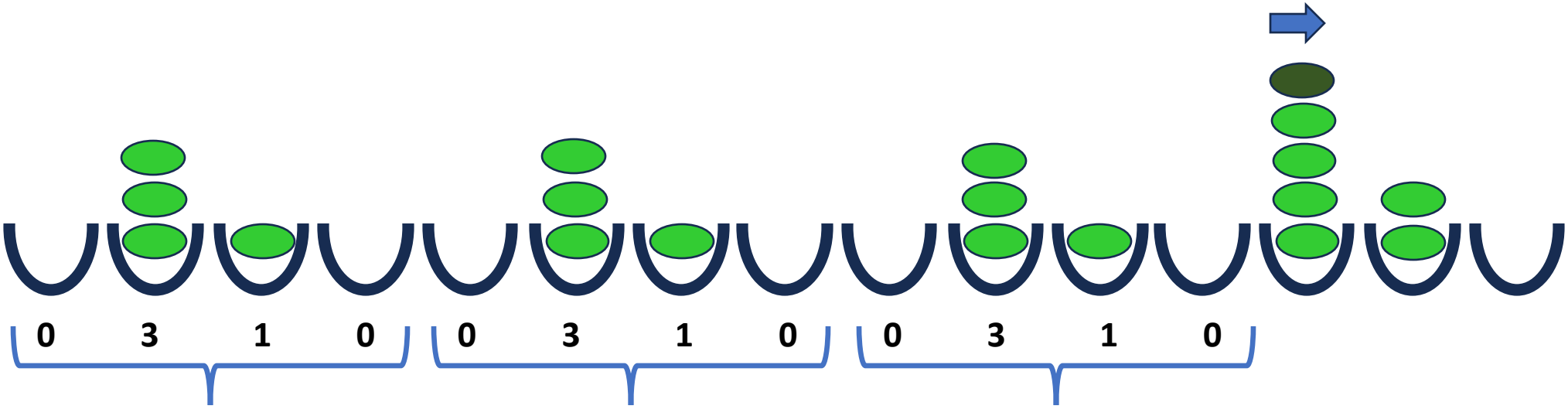
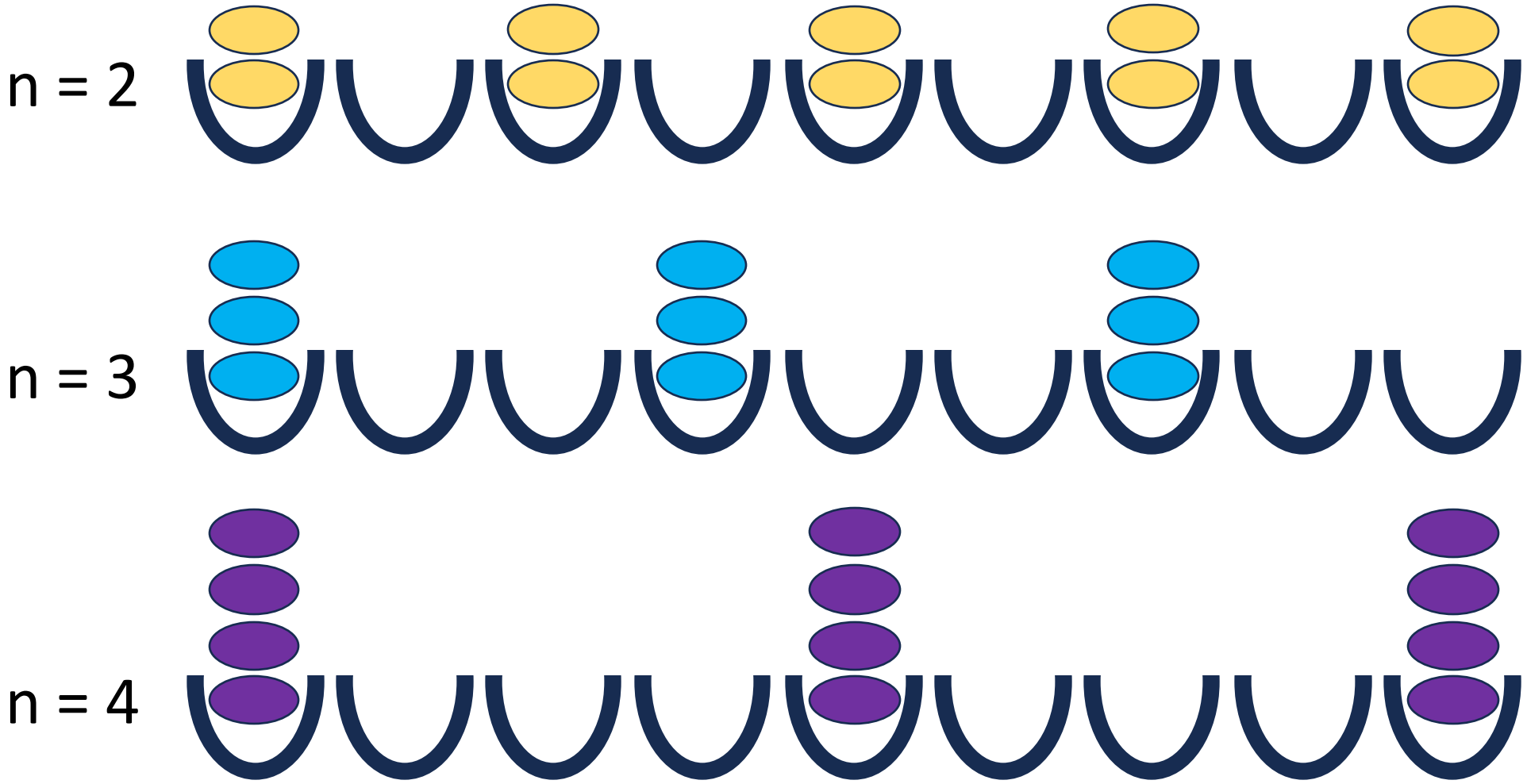


Infinite Mancala

Generalisation



Infinite Mancala

n = 2, nice and simple…

n = 2

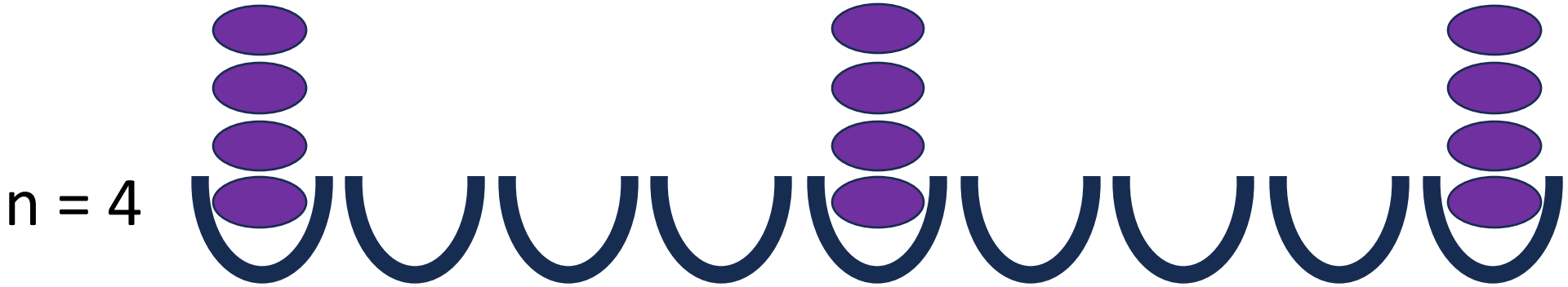
Does n=2 go periodic?

Yes, after approximately 2-3 thousand moves

Periodic trail is:- 1 3 0 0 0 1 1 0 1 5 2 0 2 2 0 0 1 1 0 0

Infinite Mancala

The case of n = 4



n = 4 goes periodic after a few hundred moves

And the periodic trail is:- 4 0 0 0

Infinite Mancala

Other small values of n

n	Moves to Periodic	Periodic Trail
1	15	0 3 1 0
2	2-3k	1 3 0 0 0 1 1 0 1 5 2 0 2 2 0 0 1 1 0 0
3		
4	<1k	4 0 0 0
5	<1k	2 2 0 7 0 2 0 2 0 0 1 0 0 1 2 0 0 3 4 0 1 0 0 0 0 2 1 0 0 0
6	About 1k	3 0 0 2 0 1
7	About 1k	3 1 0 0 2 1 0
8	About 2k	0 2 3 2 0 0 0 1 4 1 0 0 0 0 0 0 1 0 1 0 1 3 2 1 4 0 1 1 2 0 1 0 0 0 3 2 2 0 0 1 2 0 1 2 0 1 0 0 0 1 0 6 0 0 1 0 1 0 2 0 0 1 0 7
9	12.8 Million	2 0 2 1 1 2 1 0 0
10	About 1k	3 1 0 2 0 0 3 1 0 0

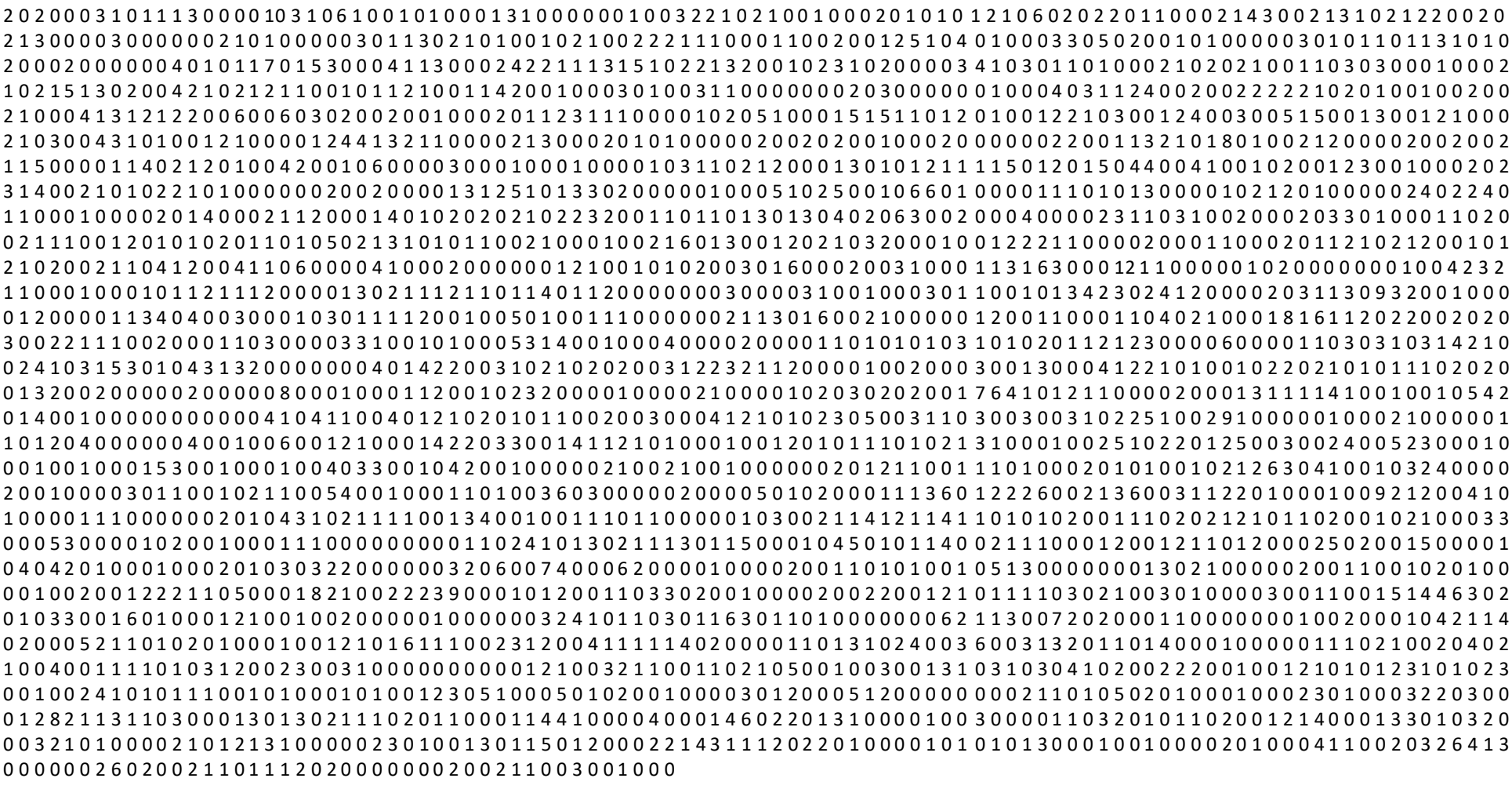
Infinite Mancala

n = 3

Infinite Mancala

Does n = 3 go periodic?

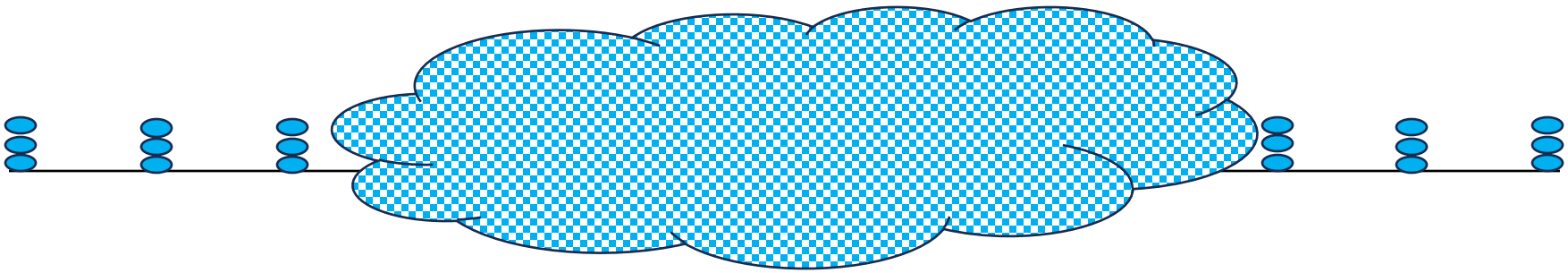
YES, after approximately 1.27 Trillion moves



Infinite Mancala

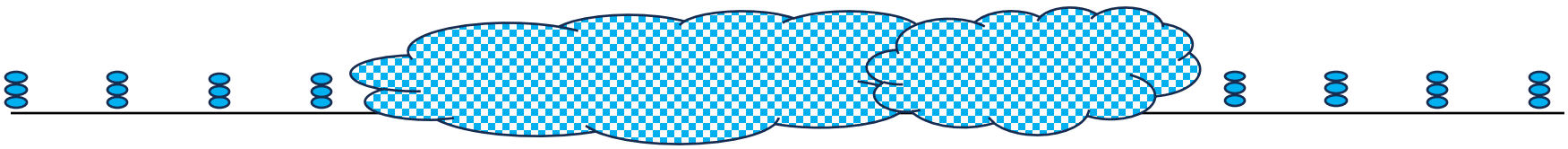
n = 3 and the Cloud of Chaos

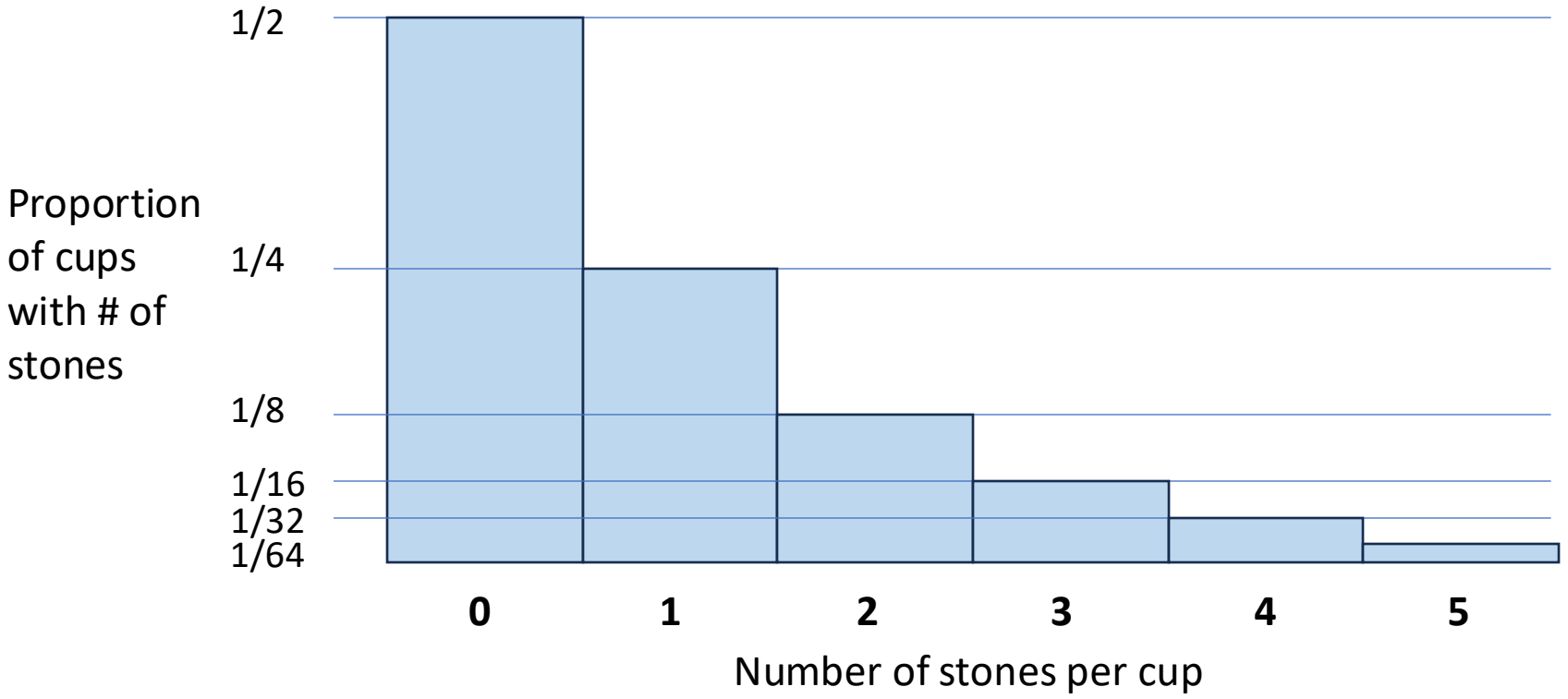
n = 3



Infinite Mancala

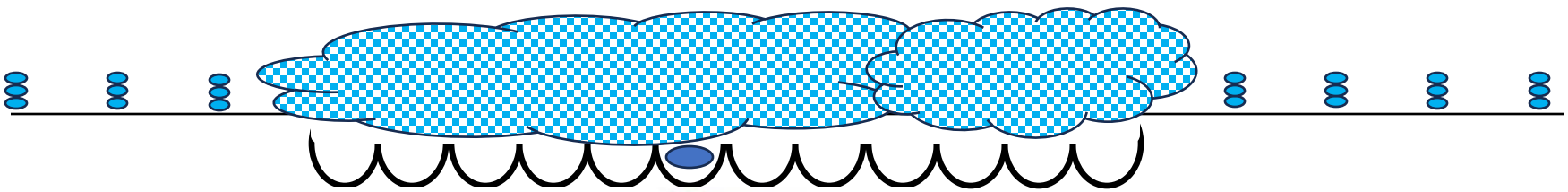
How random is the Cloud of Chaos?





Infinite Mancala

How random is the Cloud of Chaos?

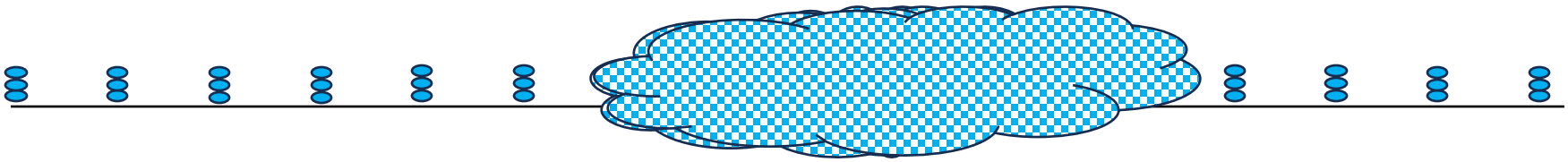


$$\text{Width} \approx 4\sqrt{\frac{N}{\pi}}$$

$$2439321 \approx 4.32\sqrt{\frac{1000{,}000{,}000{,}000}{\pi}}$$

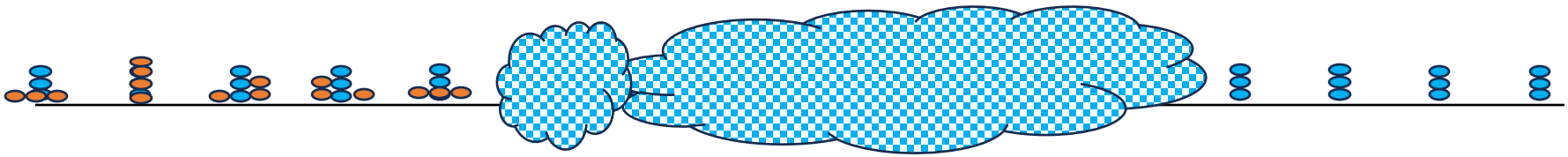
Infinite Mancala

How random is the Cloud of Chaos?



Infinite Mancala

How random is the Cloud of Chaos?



Infinite Mancala

Larger values of n

n	Periodic Trail
26	0 0 2 0 4 0 5 1 1 1 0 0 0 0 3 0 0 1 3 0 0 1 3 0 0 1
30	0 0 2 0 4 0 5 1 1 1 0 0 0 0 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1
34	0 0 2 0 4 0 5 1 1 1 0 0 0 0 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1
38	0 0 2 0 4 0 5 1 1 1 0 0 0 0 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1
42	0 0 2 0 4 0 5 1 1 1 0 0 0 0 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1 3 0 0 1
•	•
•	•
•	•

Infinite Mancala

Does n = 21 go periodic?

No period after 21 trillion moves.

Infinite Mancala

Open Questions

- Does n = 21 go periodic? (Not in the first 21 Trillion moves.)
- Do all density=1 periodic start positions go periodic?
- Do all periodic start positions go periodic?
- Does the reverse algorithm also tend to go periodic?
- Can the regularity of large n be proven?
- Is the algorithm Turing Complete?