Polyomino Collinearity

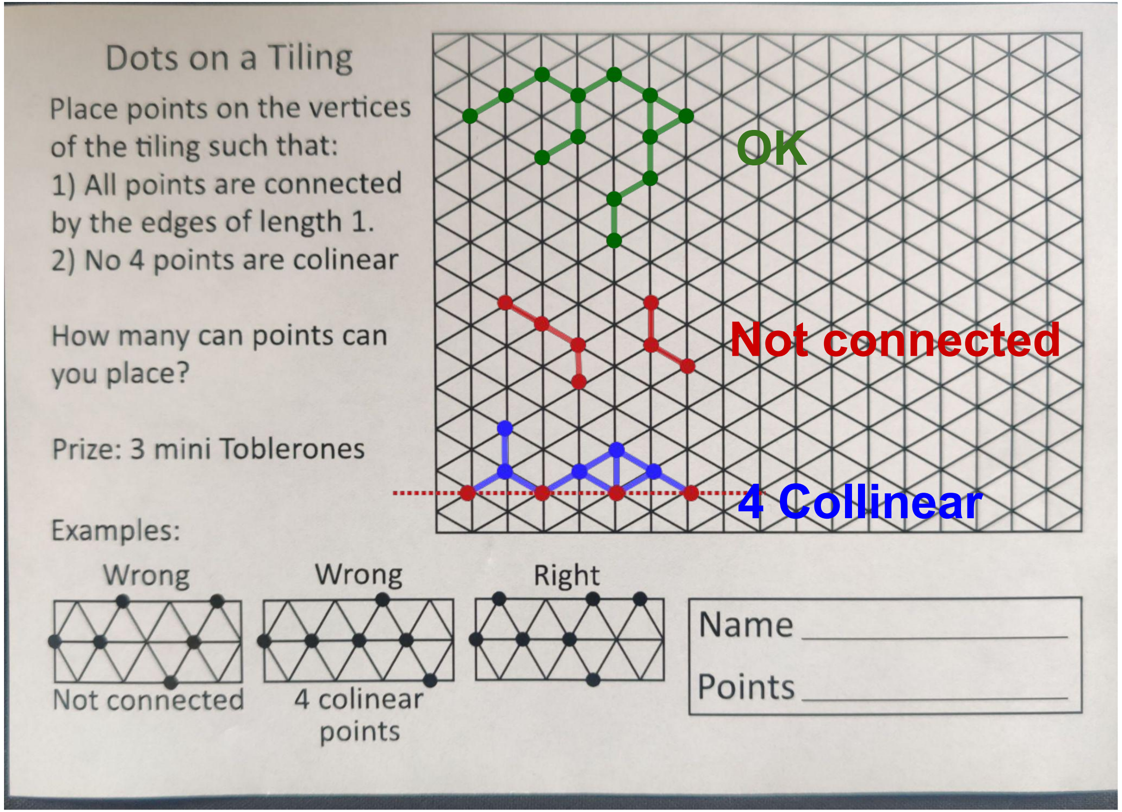
(or: The Joy of Recreational Maths)

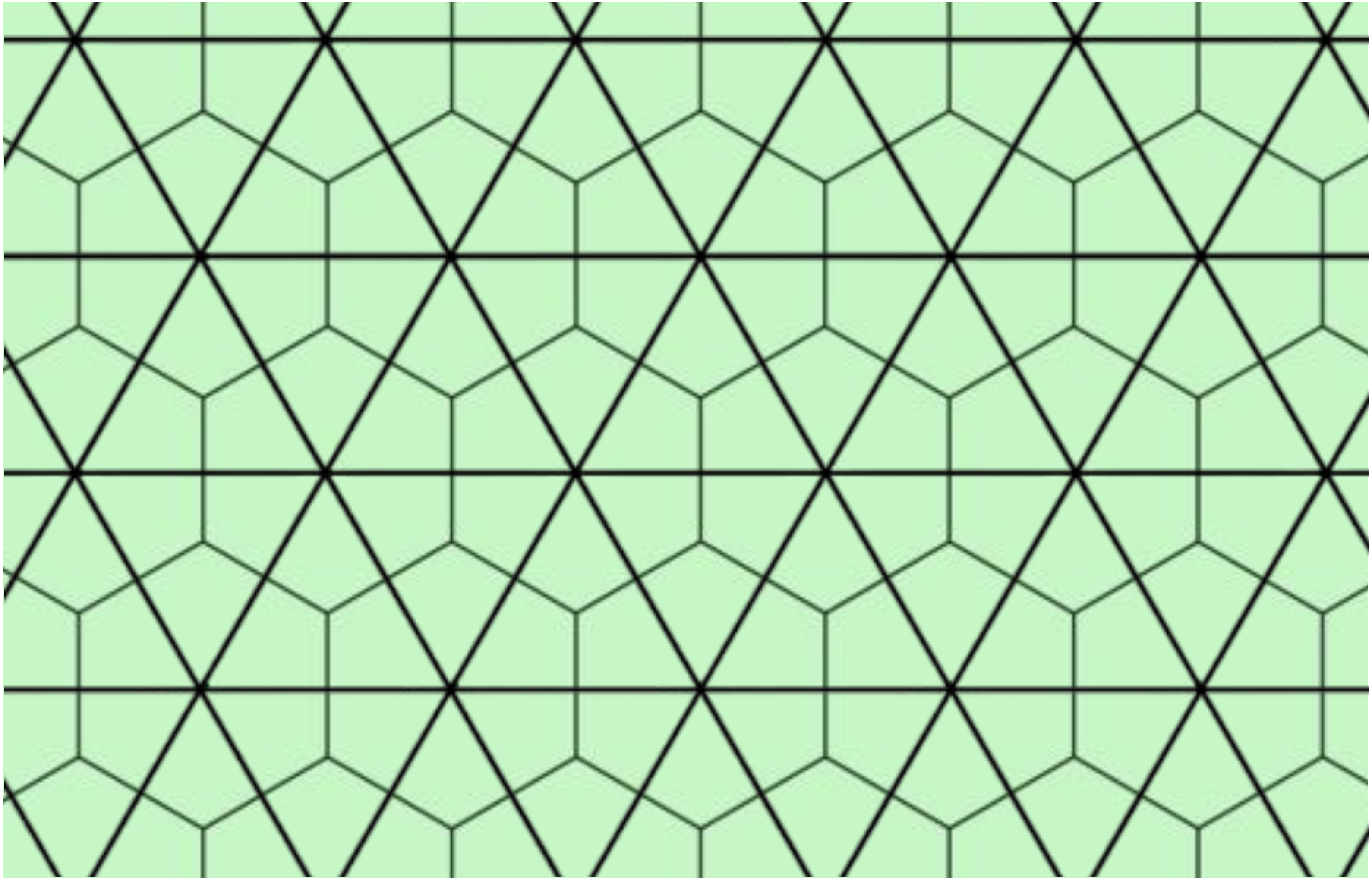
Dots on a Tiling

2024 Competition

by

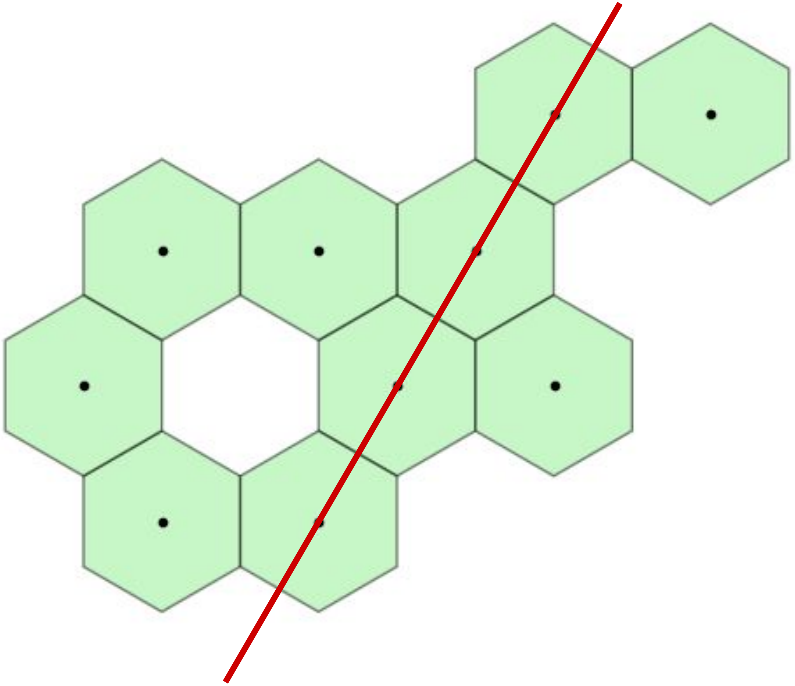
Declan O'Donnell





Make a single pattern of tiled hexagons

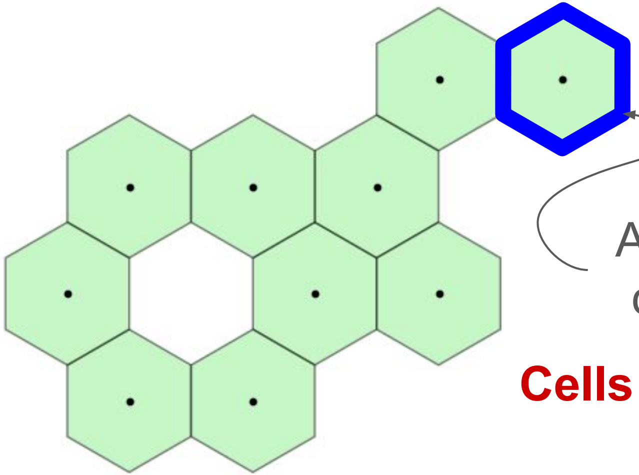
With no more than 3 tile centres on any line in the plane



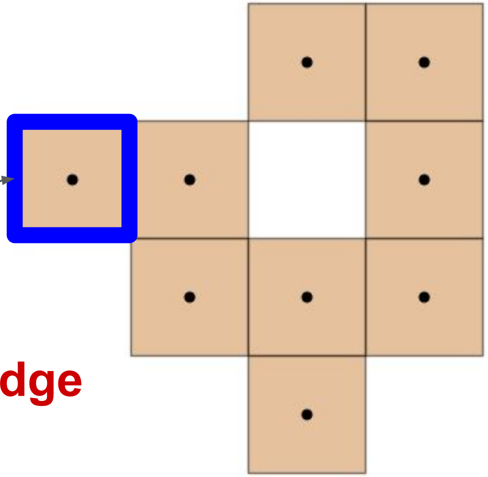
Pattern of Tiles = Polyomino

Hexagonal Polyomino (or Polyhex)

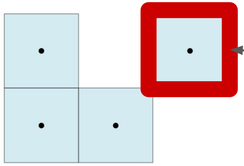
Square Polyomino (or Polyomino)



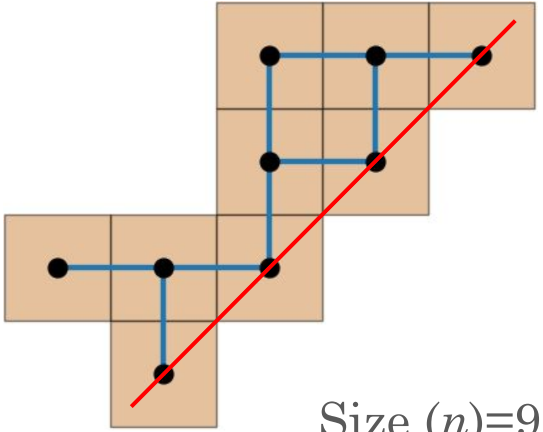
A single tile is called a ***cell***



Cells connect via an edge



Not a polyomino - cell not connected

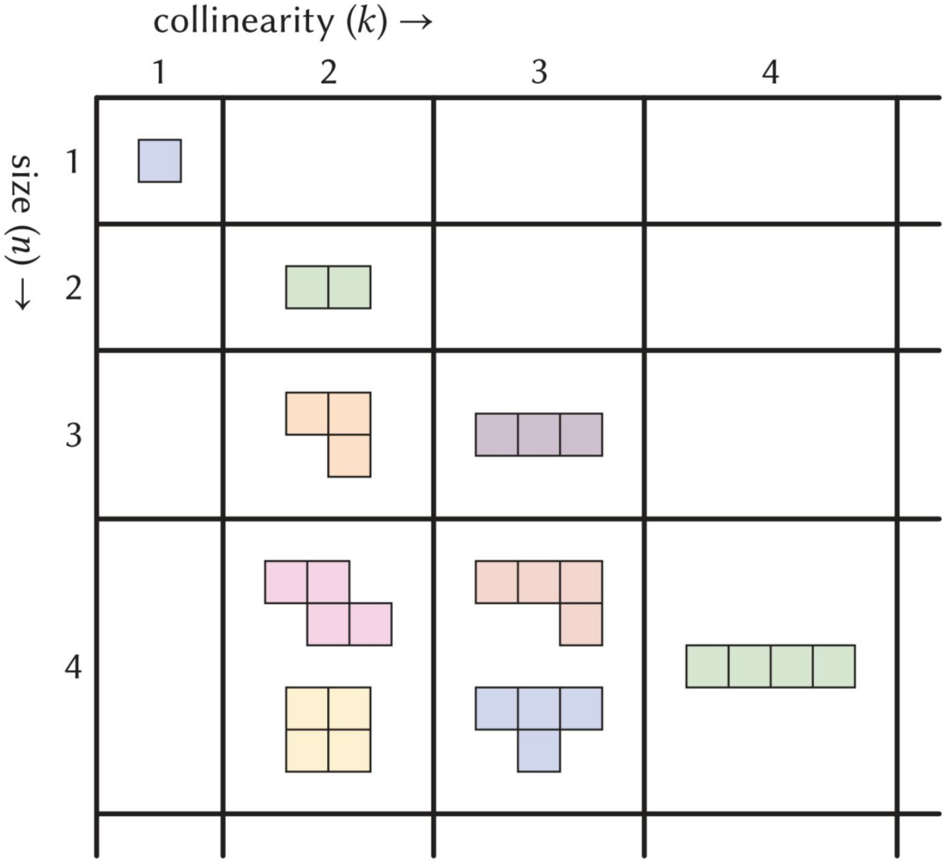


Size (n)=9

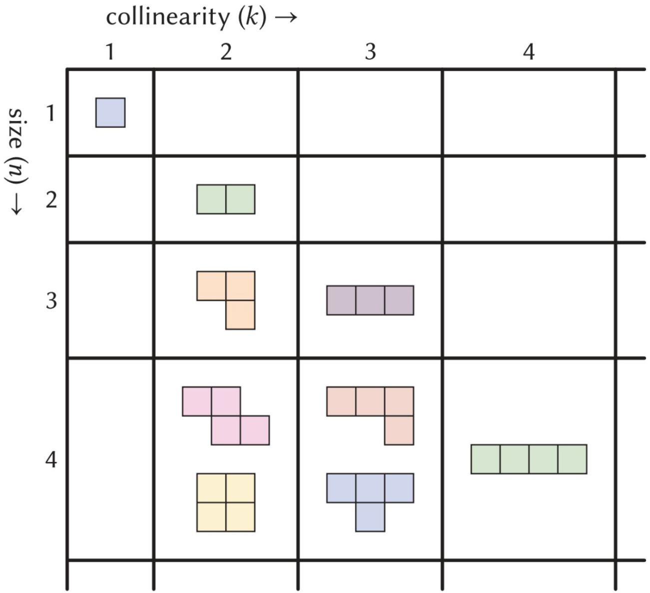
Collinearity (k)

The largest number of cell centres on any line in the plane.

$k = 4$

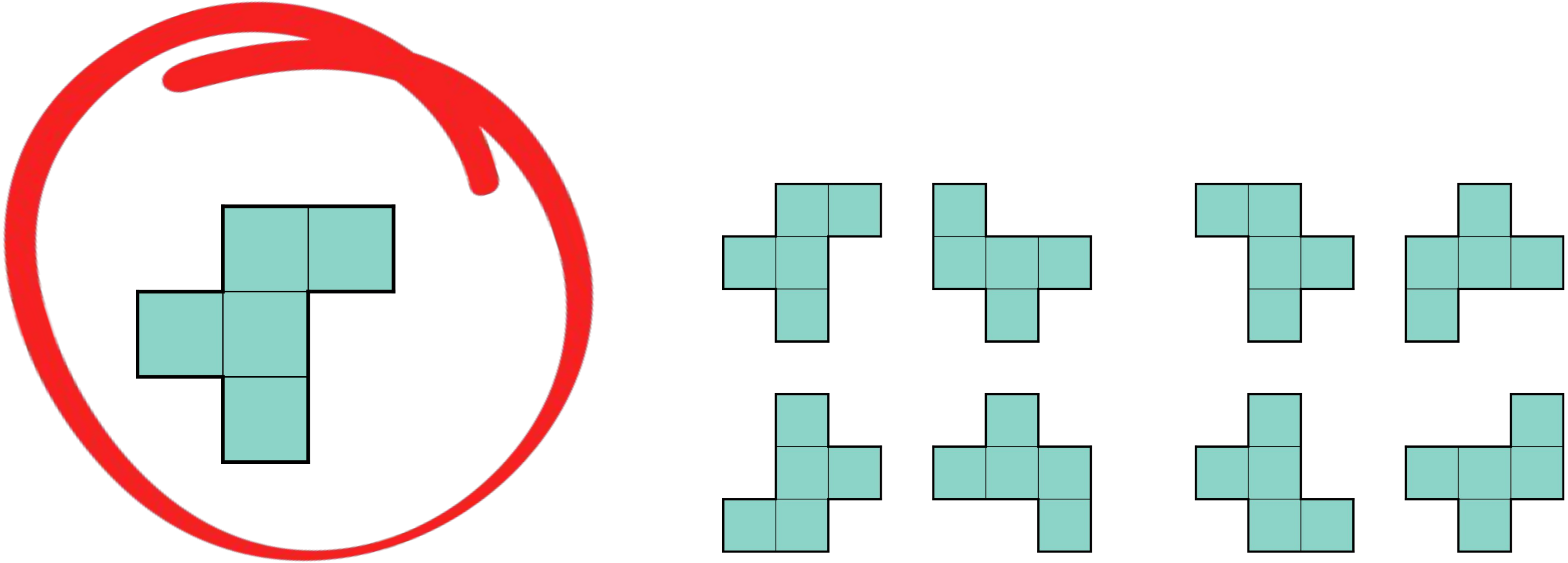


$P(n,k)$ = { polyominoes with **Size = $\boldsymbol{n}$** and **Collinearity = $\boldsymbol{k}$** }



n	k = 1	2	3	4	$\lvert P(n) \rvert$
1	1				1
2		1			1
3		1	1		2
4		2	2	1	5

What am I Counting ?



$|P(n,k)|$ for the Square (oeis: A378169)

collinearity (k) →

← size (n)

n	1	2	3	4	5	6	7	8	9	10	$P(n)$
1	1										1
2		1									1
3		1									2
4		2									5
5											12
6											35
7											108
8											369
9											1285
10			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	4655

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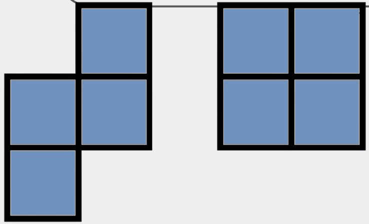
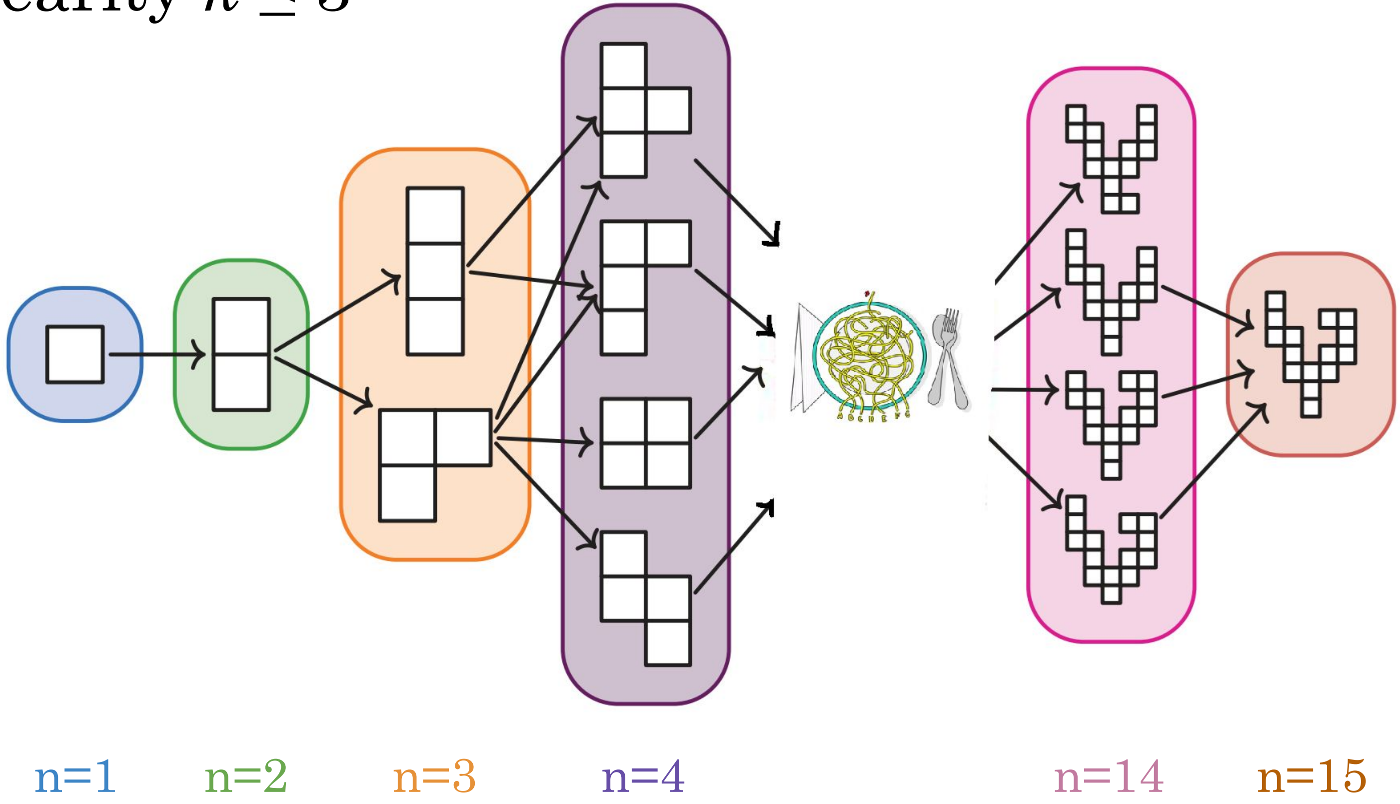
What is the largest polyomino with

$k \le 3$?

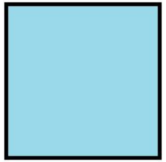


Collinearity $k \leq 3$



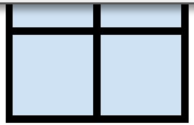
Largest square solutions for a limited collinearity (k)

$k \le 1$



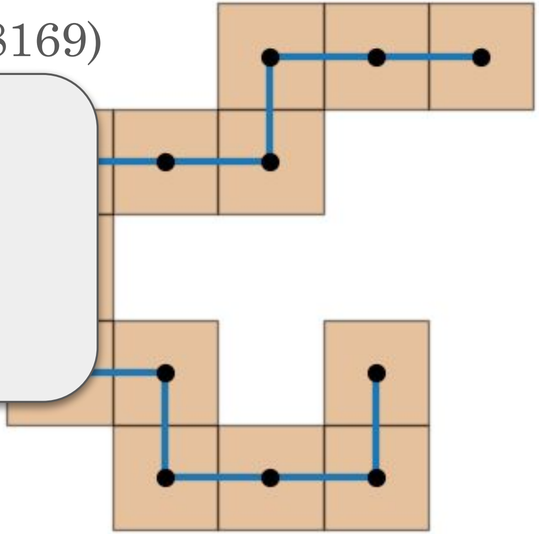
$n = 1$

$k \le 2$



$n = 4$

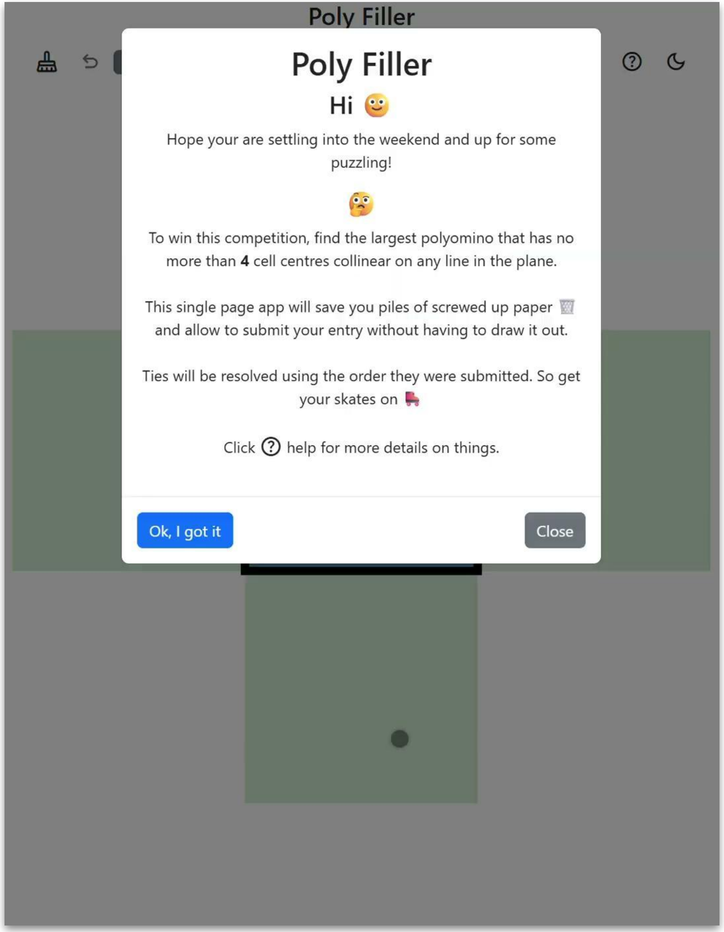
$k \le 3$
(oeis: A378169)



$n = 15$

$k \le 4$?

tinyurl.com/comp-polyfiller



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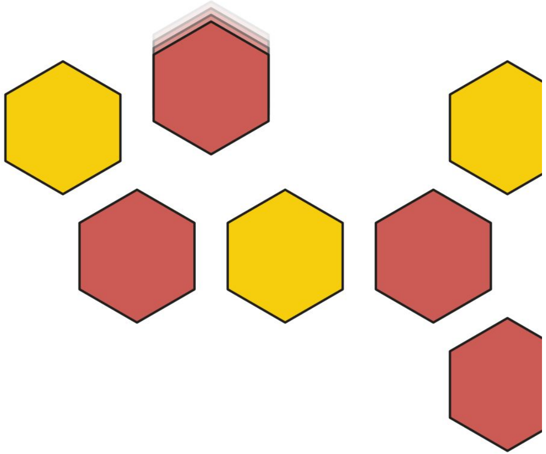
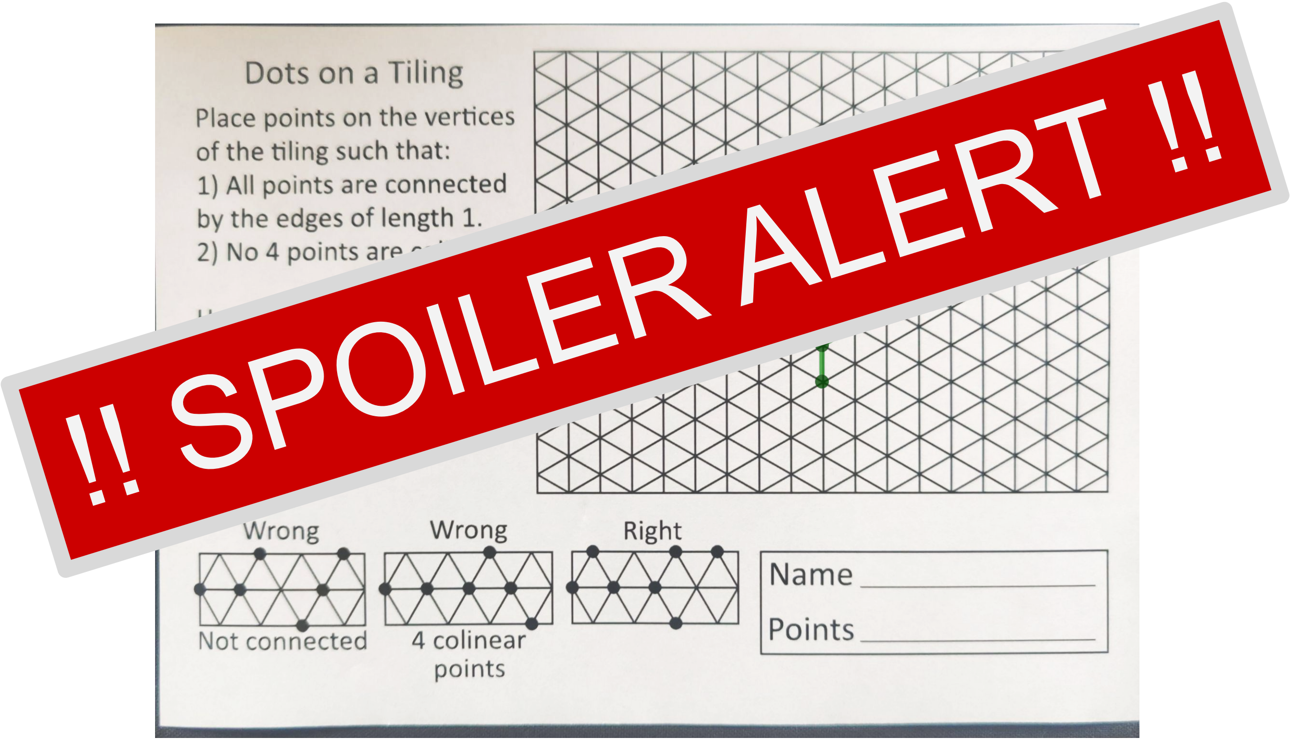
Don't connect four

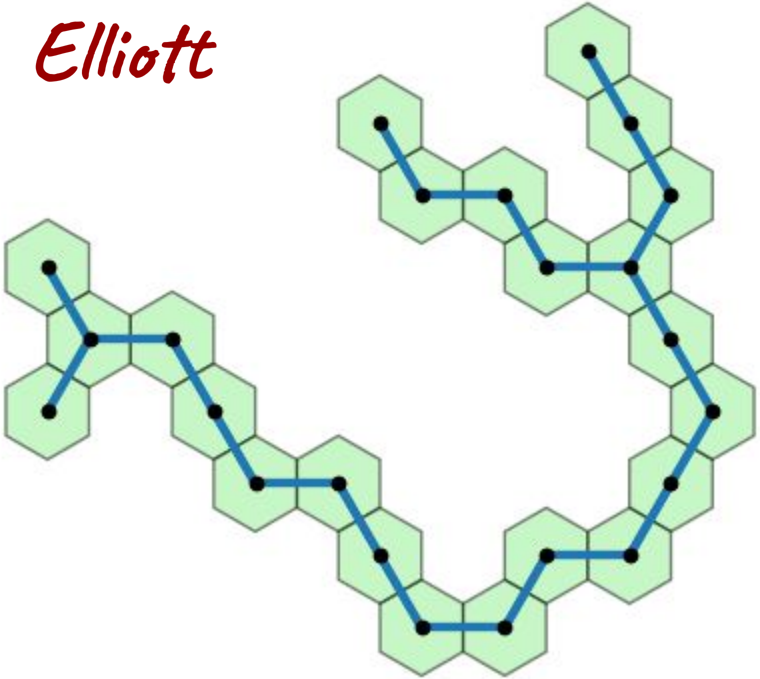


Hexagon: Largest solutions for $k \leq 3$

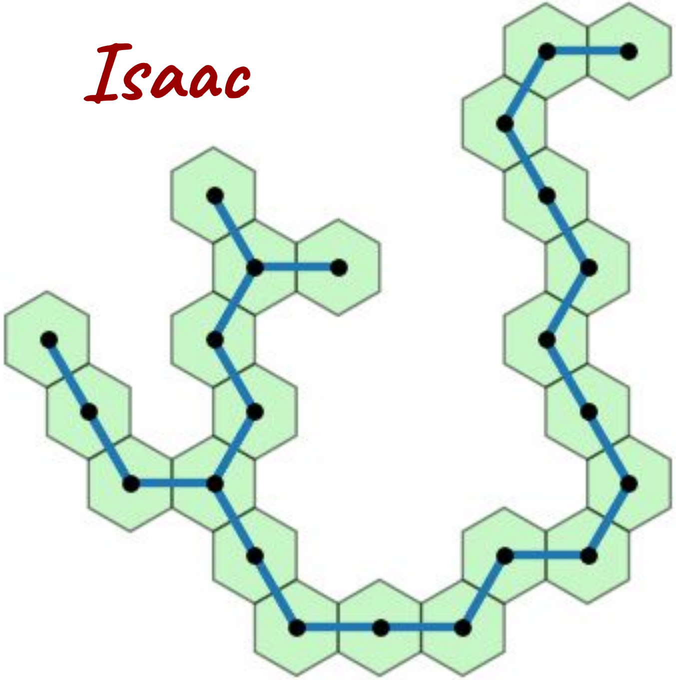


Hexagon: Largest solutions for $k \leq 3$

Elliott



Isaac



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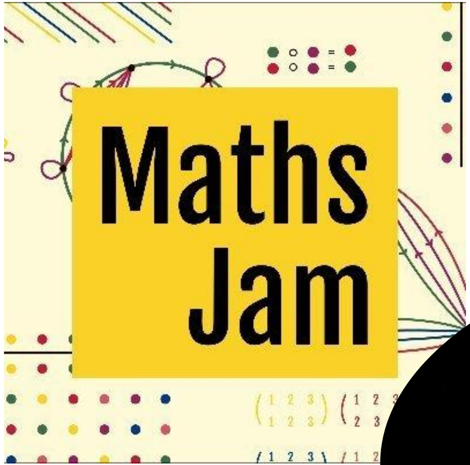

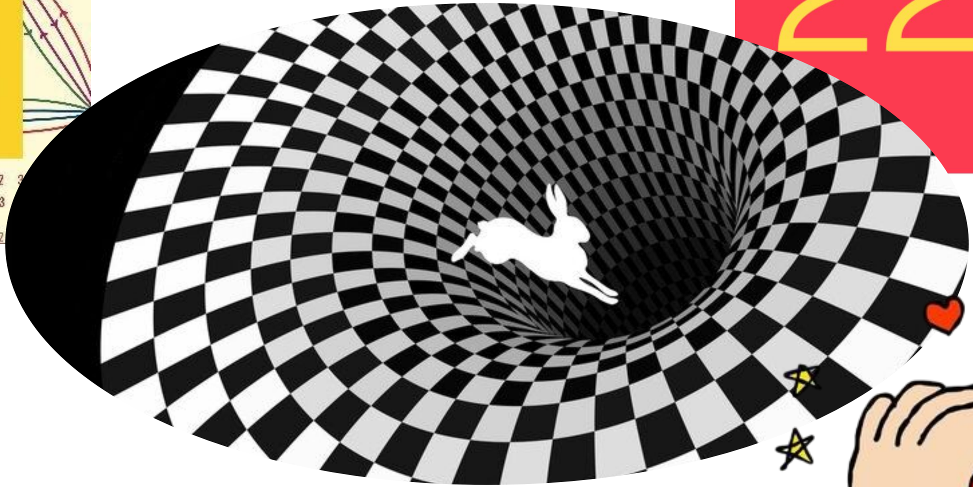

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founded in 1964 by N. J. A. Sloane