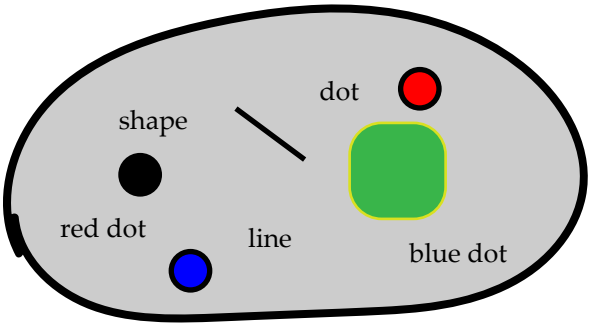
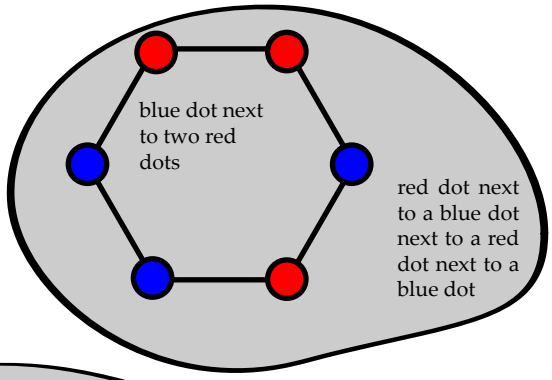
Determine the Dots

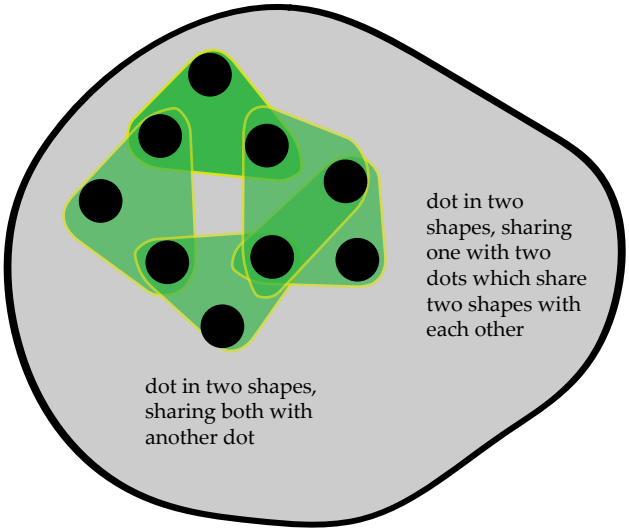
Josh Laison

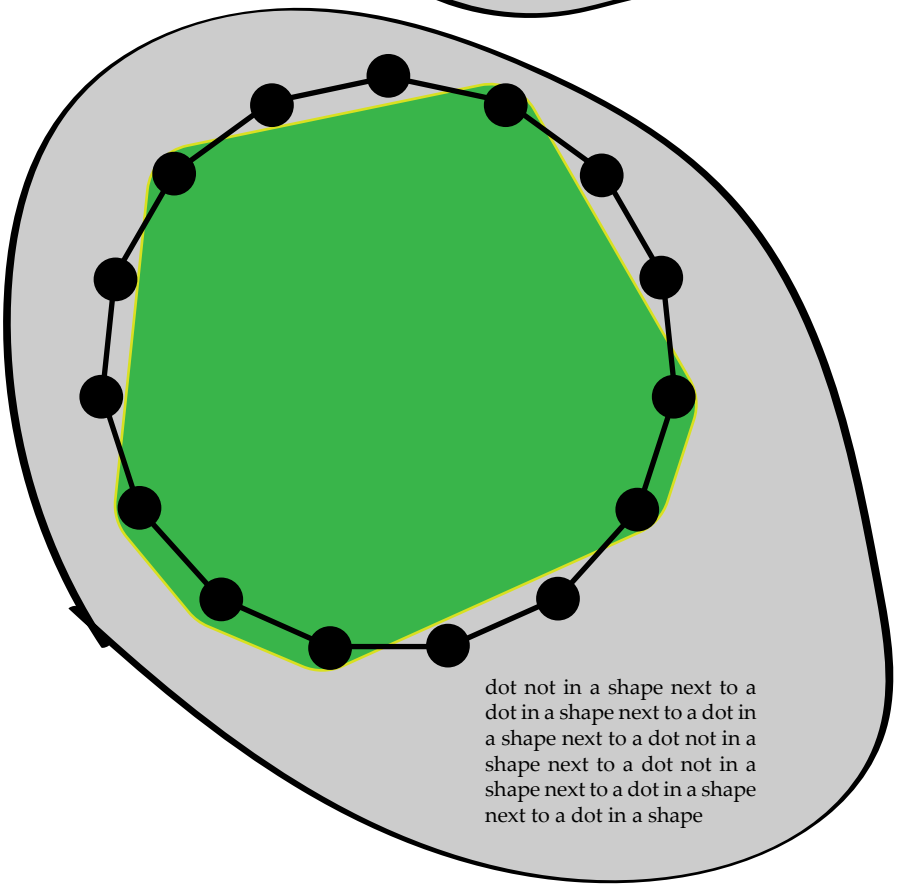
Developed from Graph Stamping: Art-Inspired Mathematics, Hazel, Laison, Kerkhoff, 2021

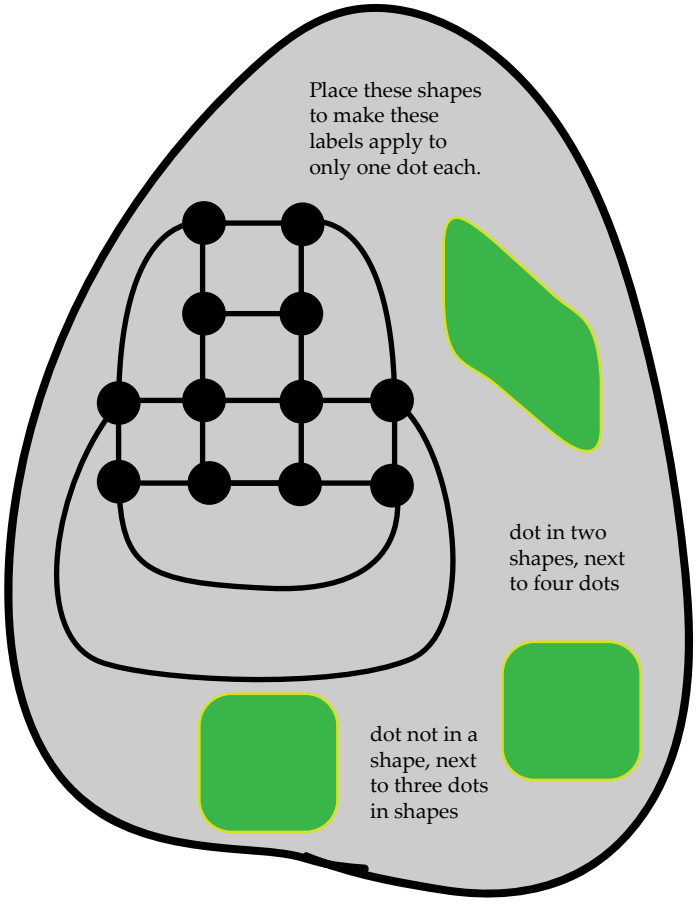
Which labels match which objects? Can all the objects be unambiguously labeled?

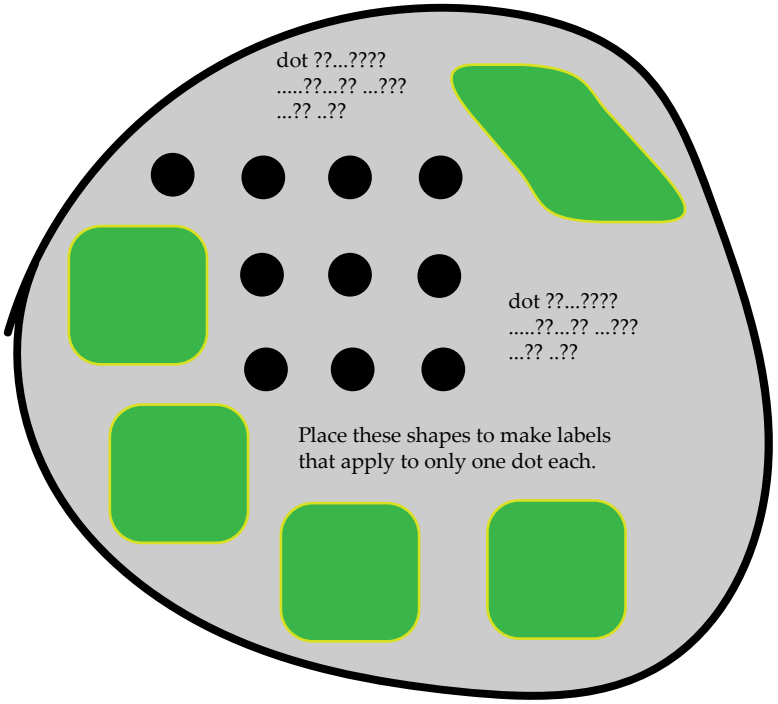






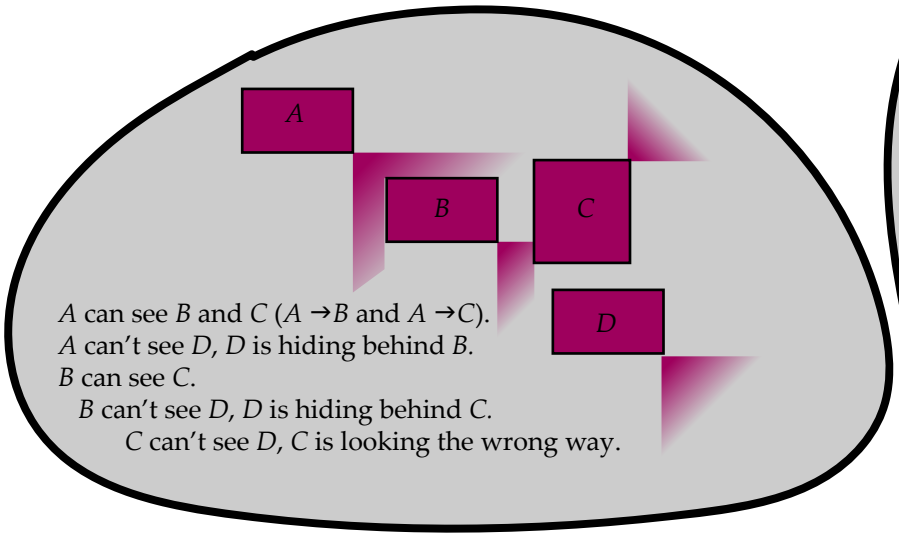






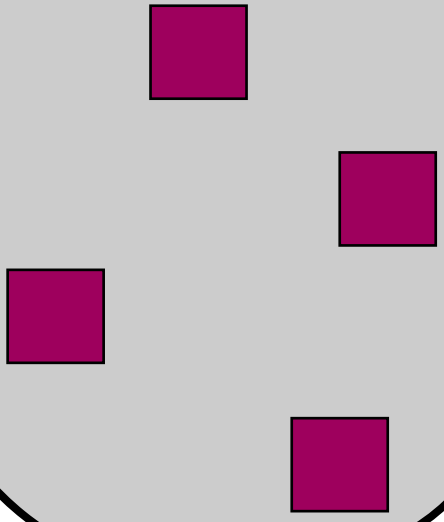
Looking Diagonally

Josh Laison
Developed from Corner Rectangle Visibility Graphs, DeYoung, Laison, Li, Southern, 2024+

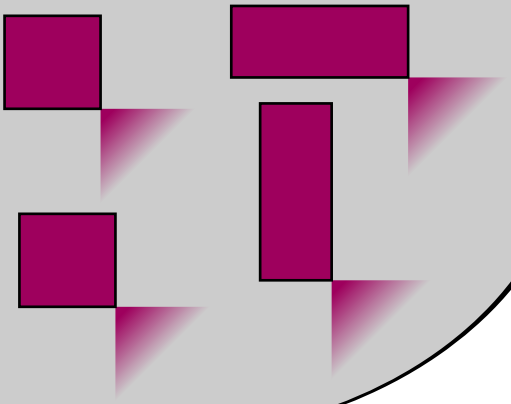


A can see *B* and *C* (*A* →*B* and *A* →*C*).
A can't see *D*, *D* is hiding behind *B*.
B can see *C*.
B can't see *D*, *D* is hiding behind *C*.
C can't see *D*, *C* is looking the wrong way.

Can all the rectangles see or be seen by every other rectangle by picking a diagonal direction to look?



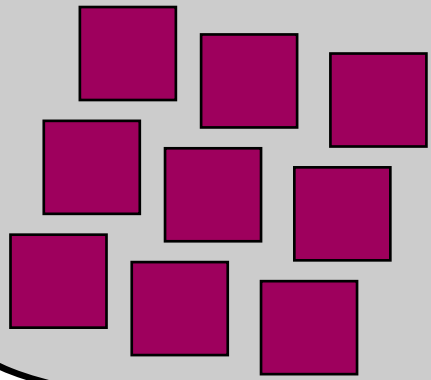
Move the rectangles so that each can see or be seen by every other rectangle, without changing which way they look.



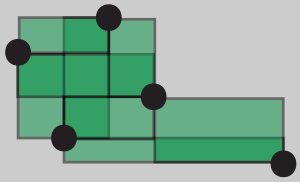
Draw rectangles that see
A→*B*, *A*→*C*, *A*→*D*, *A*→*E*, *F*→*A*,
B→*C*, *C*→*D*, *D*→*E*, *E*→*F*, *F*→*B*.

Draw rectangles that see
A→*B*, *A*→*C*, *A*→*D*, *B*→*E*, *B*→*D*,
C→*B*, *C* →*D*, *D* →*E*, *D*→*A*,
E→*A*, *E* →*B*, *E*→*C*.

Can every rectangle see two other rectangles that don't see it by picking a diagonal direction to look?



Here are 5 corner points.
Make a rectangle with corners at two of the corner points if the rectangle doesn't contain another corner point inside it.



How many rectangles are there with these 5 corner points?
With 6 corner points, how many rectangles can you get?

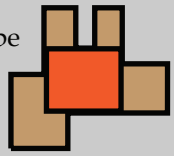
Inside Shapes

Josh Laison

Developed from Intersection Graphs of Maximal Sub-polygons of k-Lizards, Daugherty, Laison, Robinson, Salois, 2023

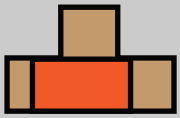
Inside shapes are convex,
have sides parallel to the big shape,
and are as big as possible.

Inside shape



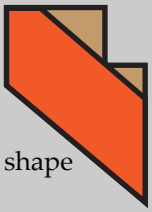
Wrong slopes,
not an inside shape

Not convex,
not an inside shape



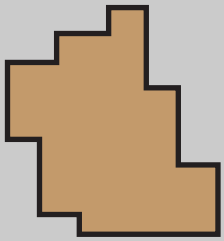
Not big enough,
not an inside shape

Not big enough,
not an inside shape

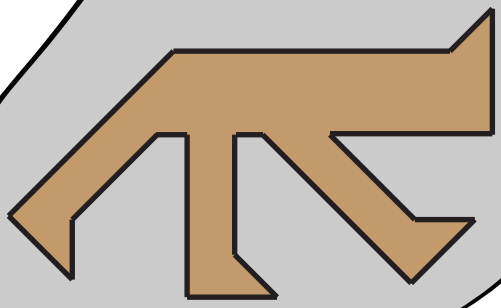


Inside shape

How many inside shapes
does this shape have?

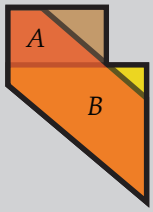


How many inside shapes
does this shape have?

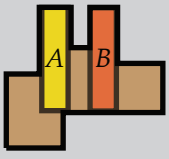


Find a shape with 10 inside shapes.

These inside shapes intersect
$A \leftrightarrow B$.



These inside shapes don't intersect
$A \not\leftrightarrow B$.



Find a shape with inside shapes intersecting
$A \leftrightarrow B$, $B \leftrightarrow C$, $C \leftrightarrow D$, $D \leftrightarrow A$, $B \leftrightarrow D$
and not intersecting
$A \not\leftrightarrow C$
and no other inside shapes

Find a shape with inside shapes intersecting
$A \leftrightarrow B$, $B \leftrightarrow C$, $C \leftrightarrow D$, $D \leftrightarrow E$, $E \leftrightarrow A$
and not intersecting
$A \not\leftrightarrow C$, $C \not\leftrightarrow E$, $E \not\leftrightarrow B$, $B \not\leftrightarrow D$, $D \not\leftrightarrow A$
and some other inside shapes.