Technische Universität Braunschweig

Computational Geometry – Exercise Meeting #5

February 16th, 2022

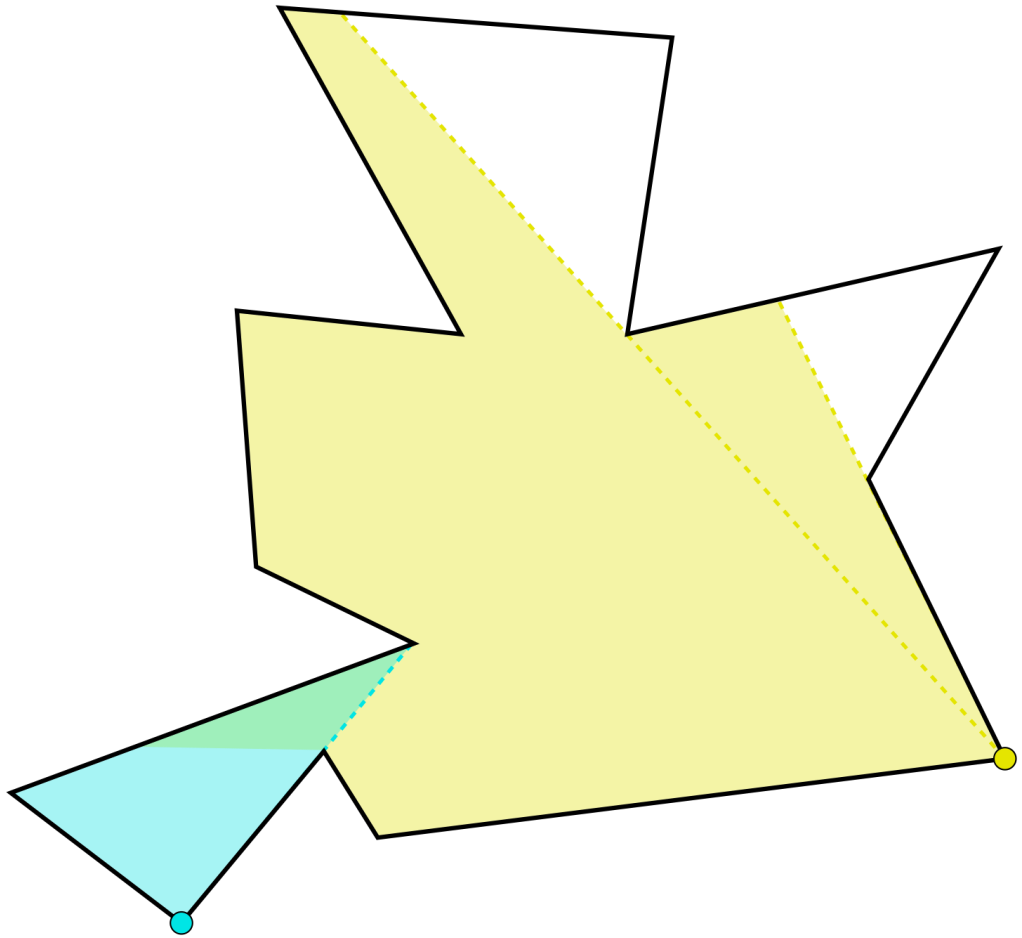
What did you think of these meetings?

Would you prefer a different format?

Do you have any ideas for next time?

E-mail us! ☺

Art Gallery Problem – Simple polygons



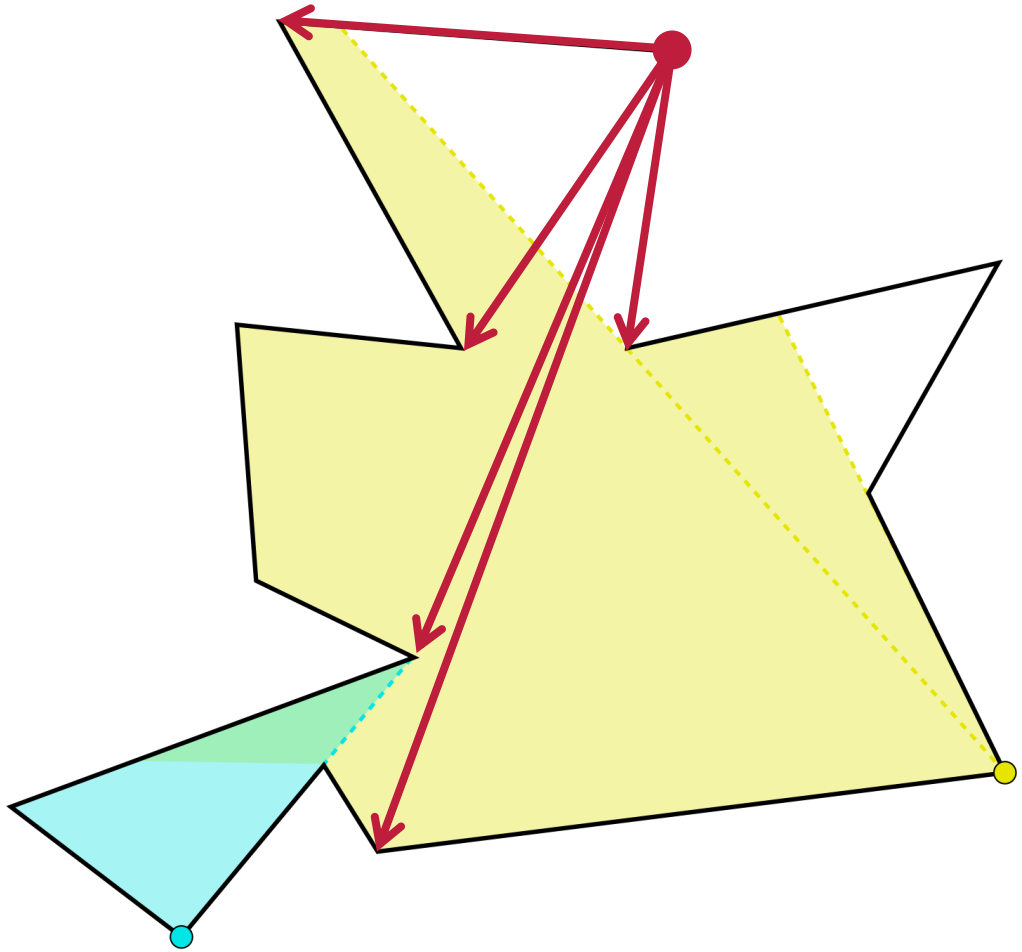
Simple polygon:

- **No intersection of edges**
- **No holes**

Guard and guard cover:

- **Represented by points**
- **Placed on vertices of the polygon**
- **Cover contains all points that are visible from the guard**

Visibility graph – Simple polygons



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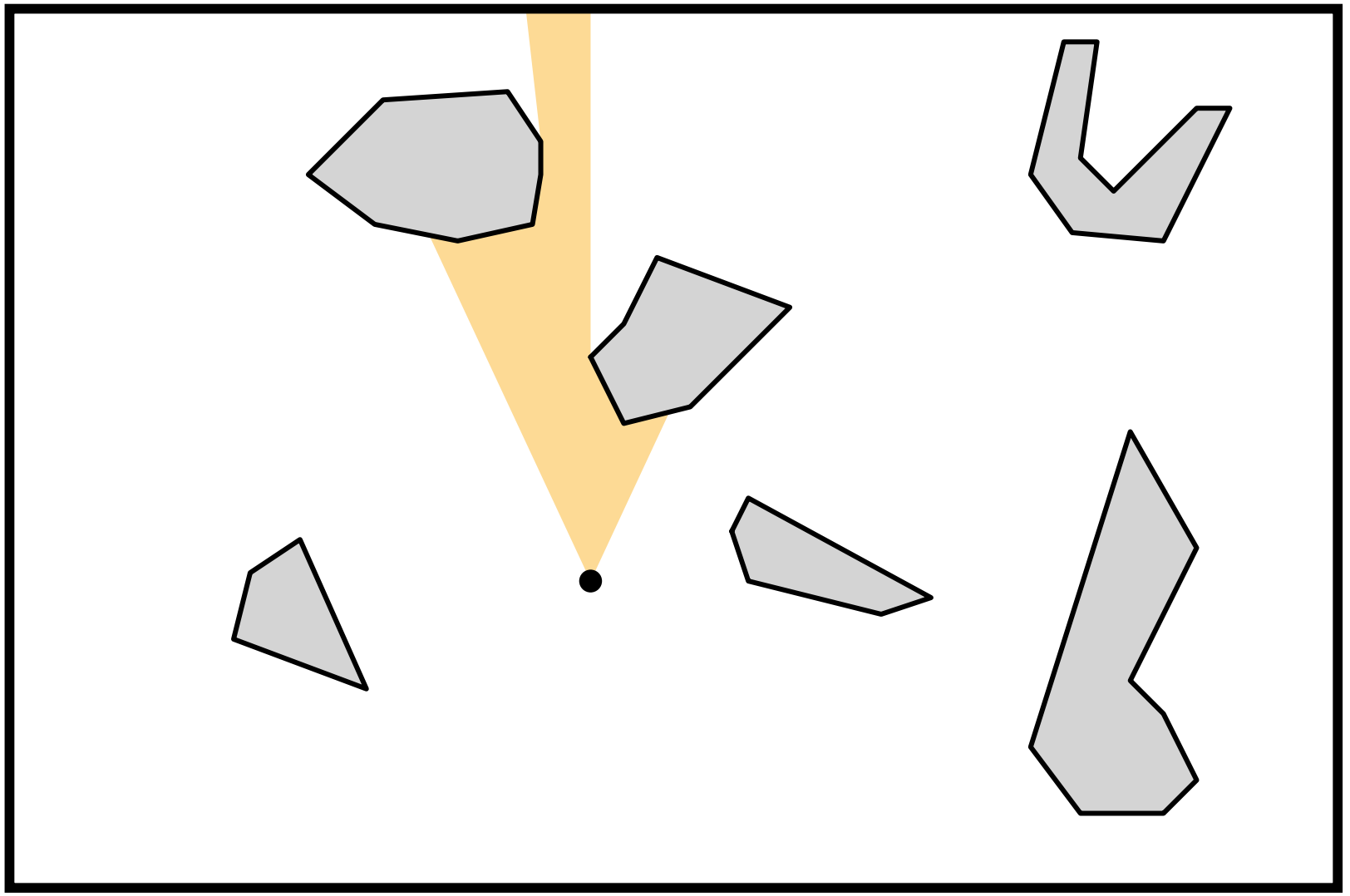
Motivation – Raytracing



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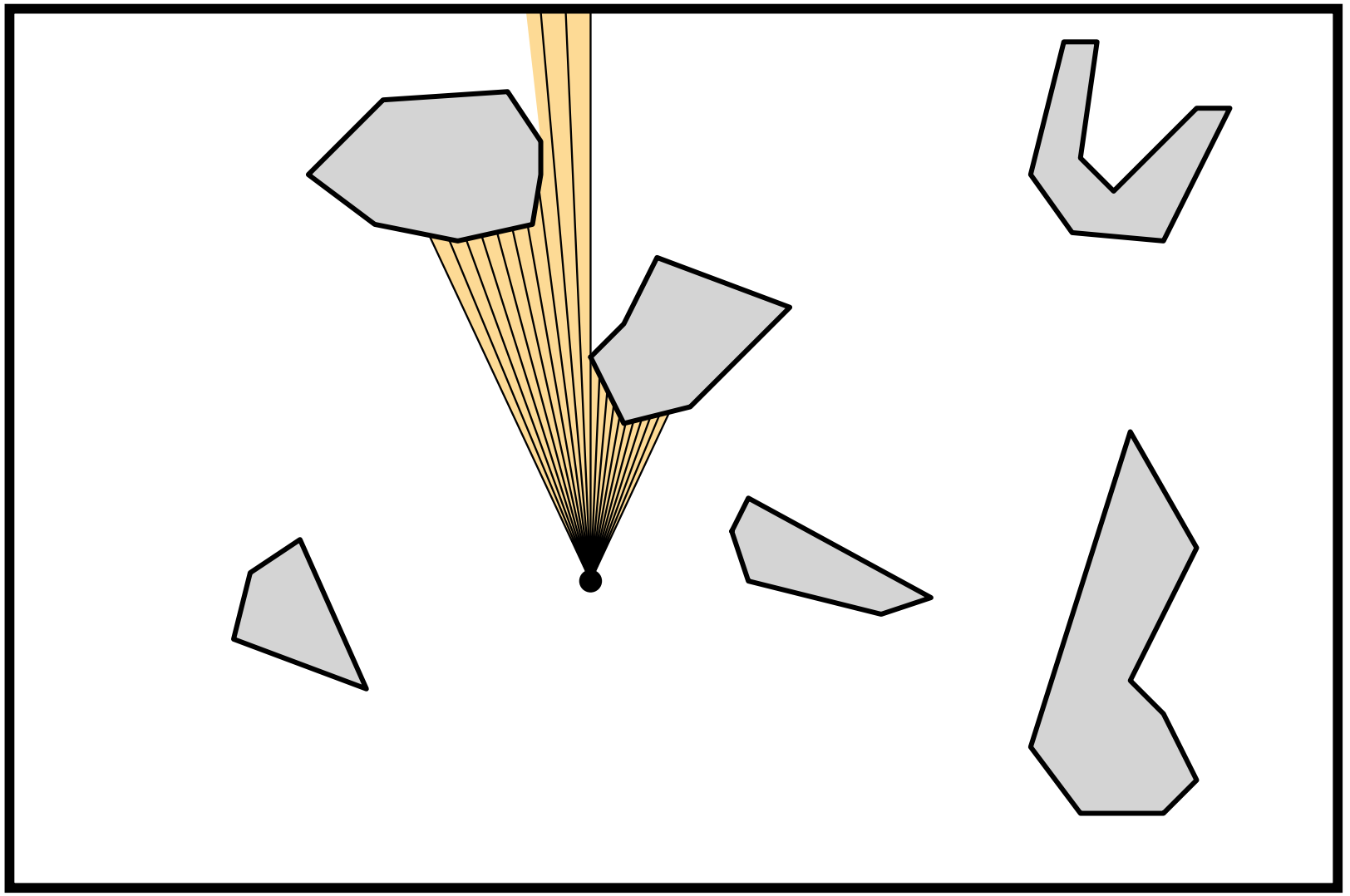

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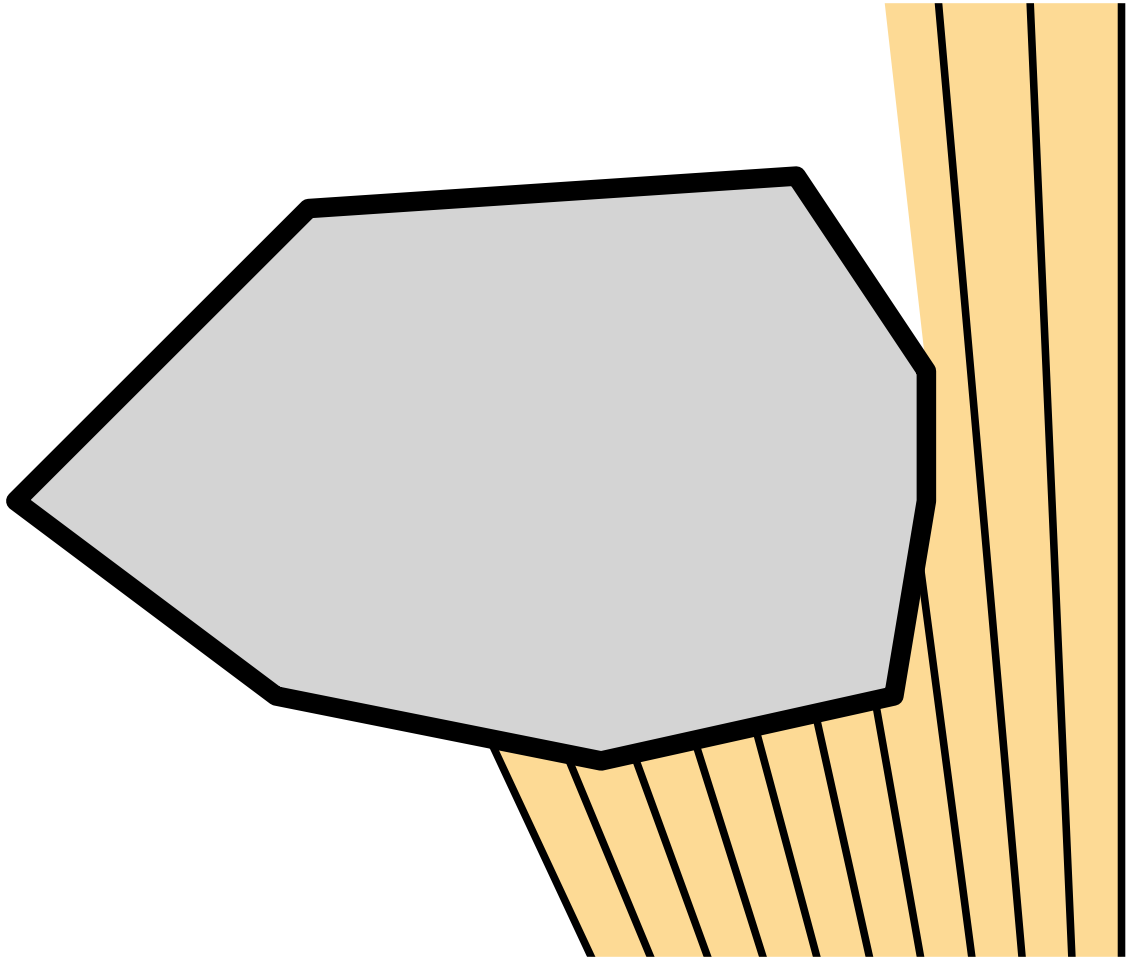
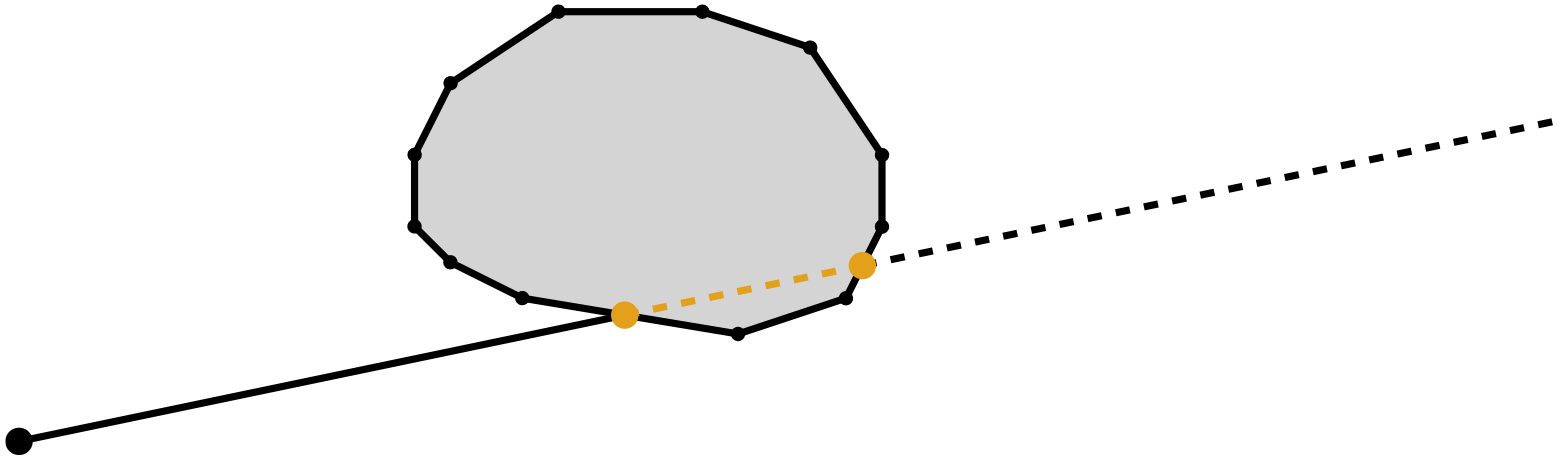
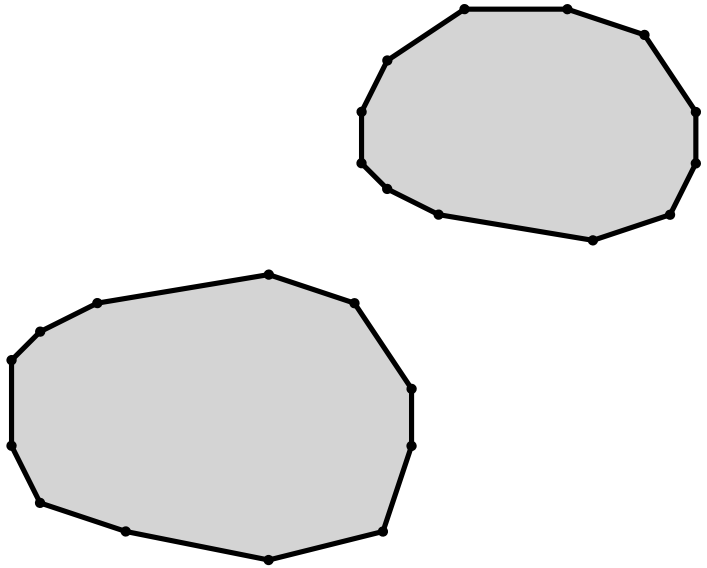


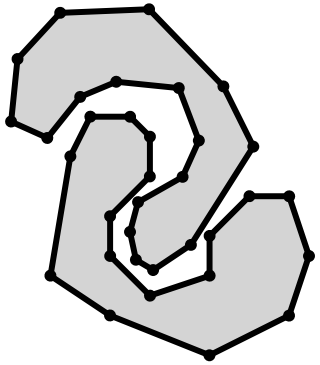
Polygon-Line intersection



Polygon-Line intersection

Polygon-Polygon intersection





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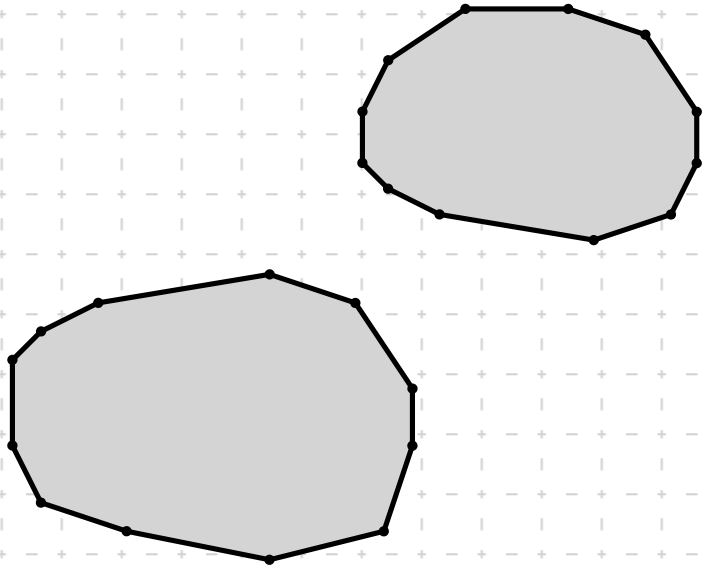
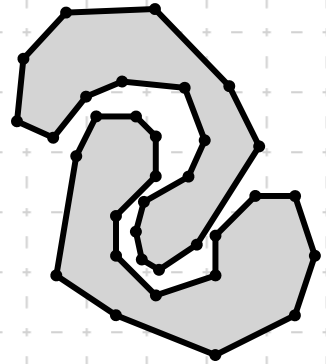
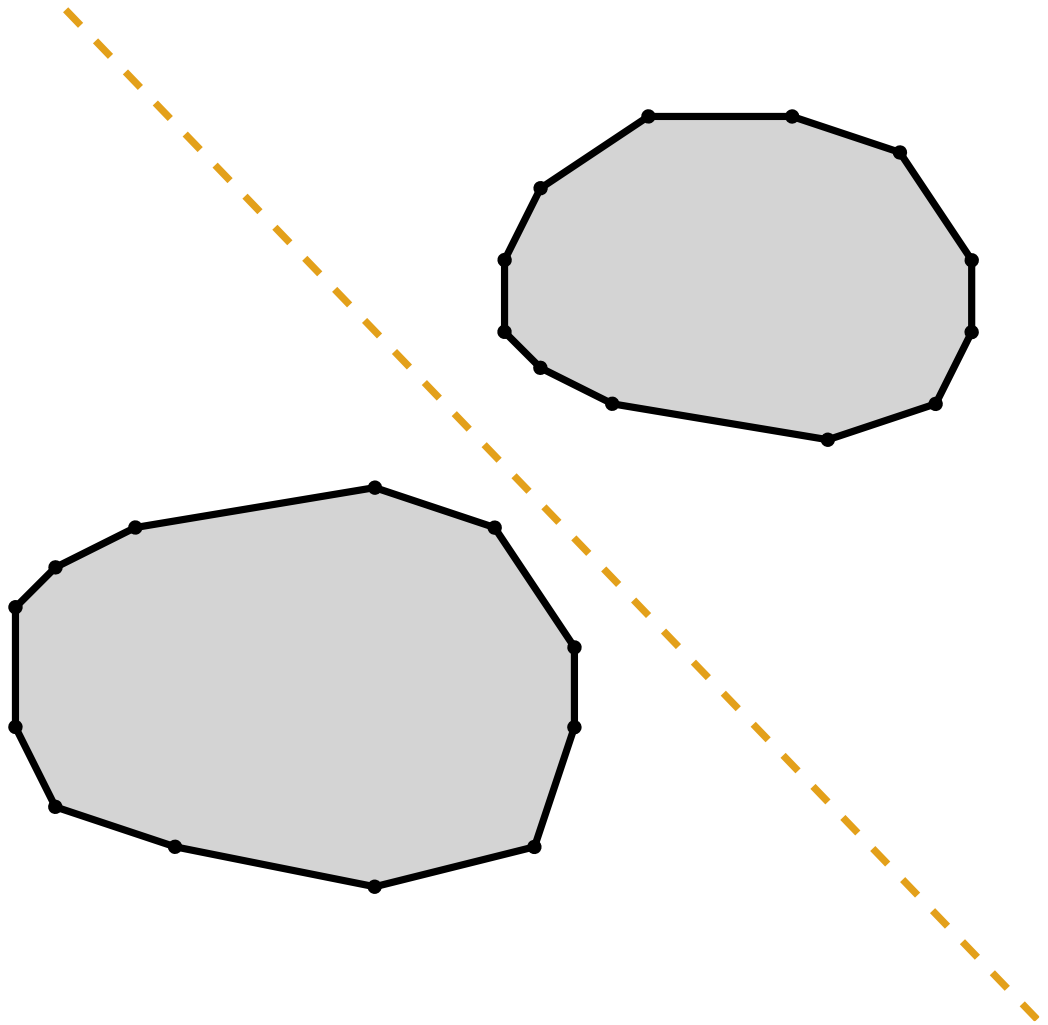




Convex-Convex intersection



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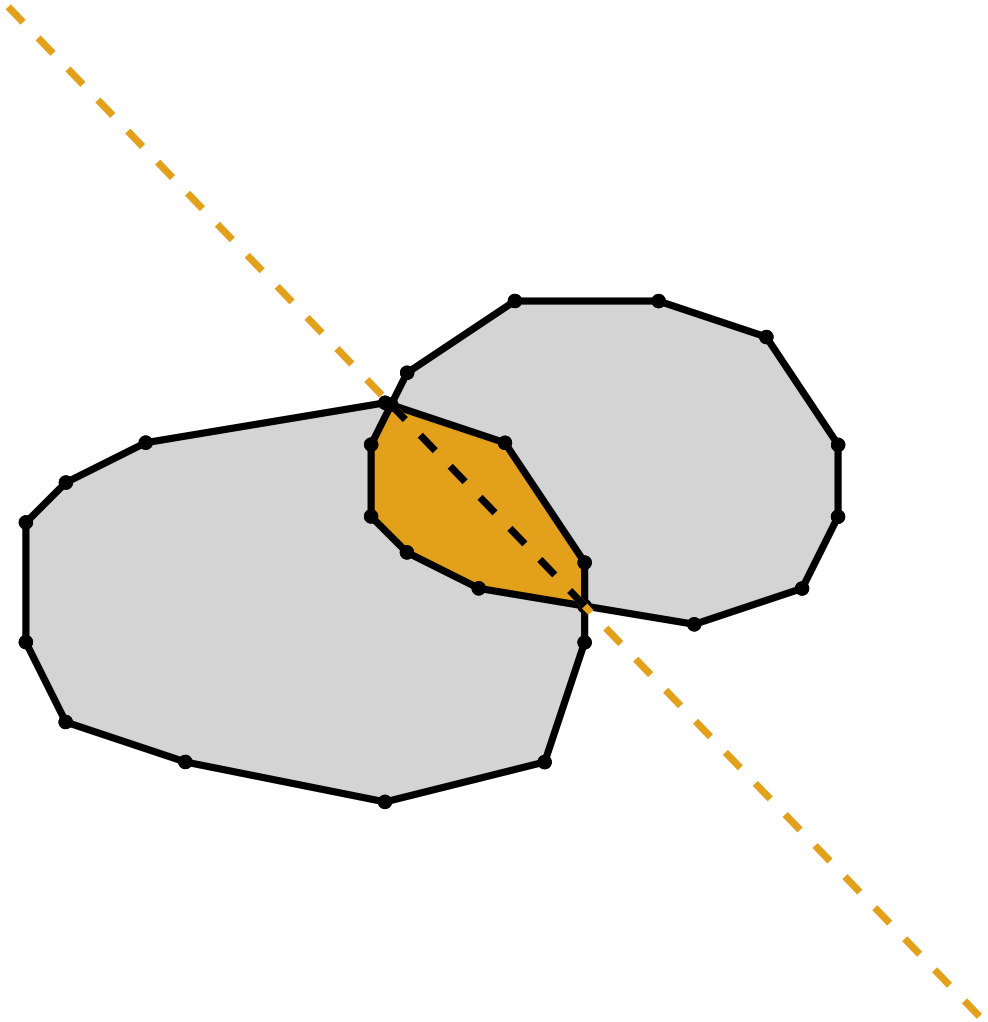

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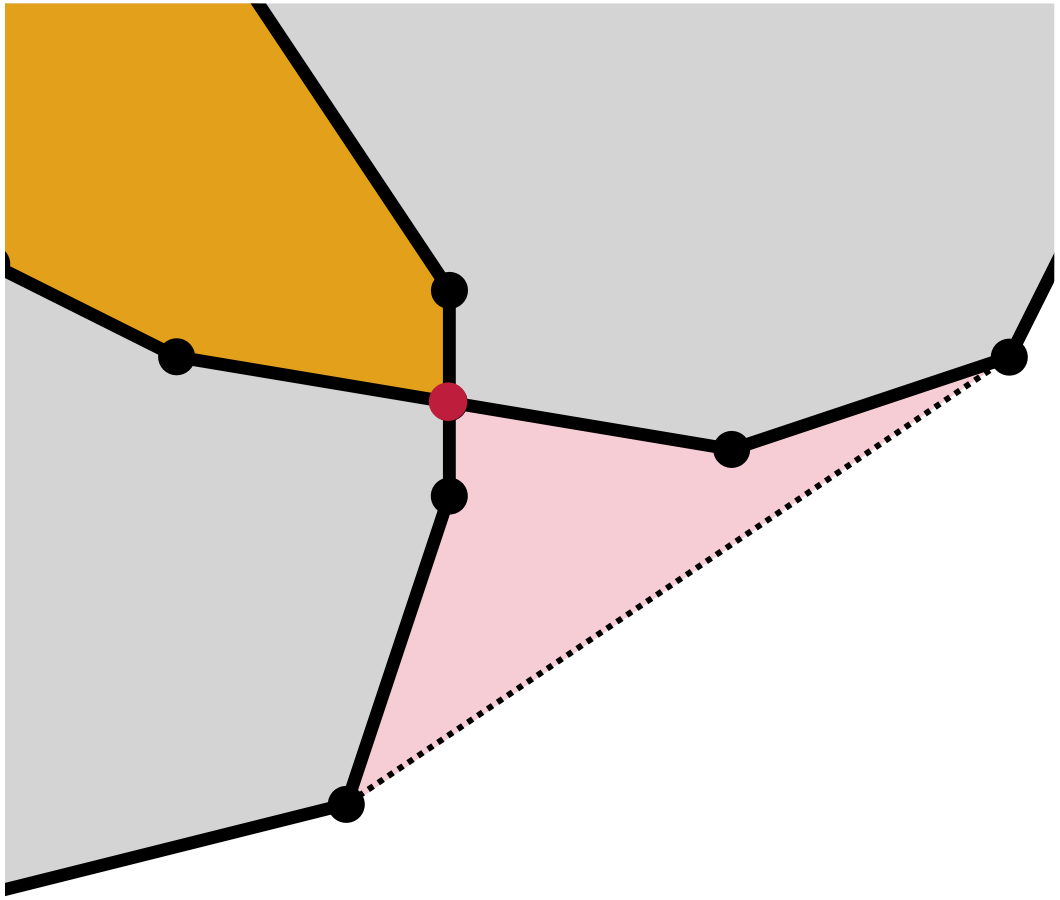
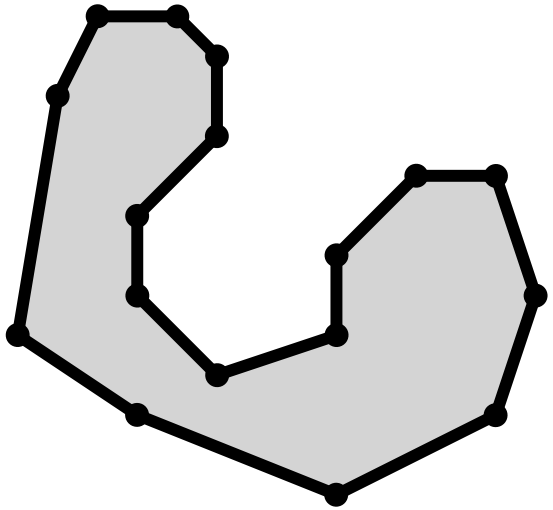


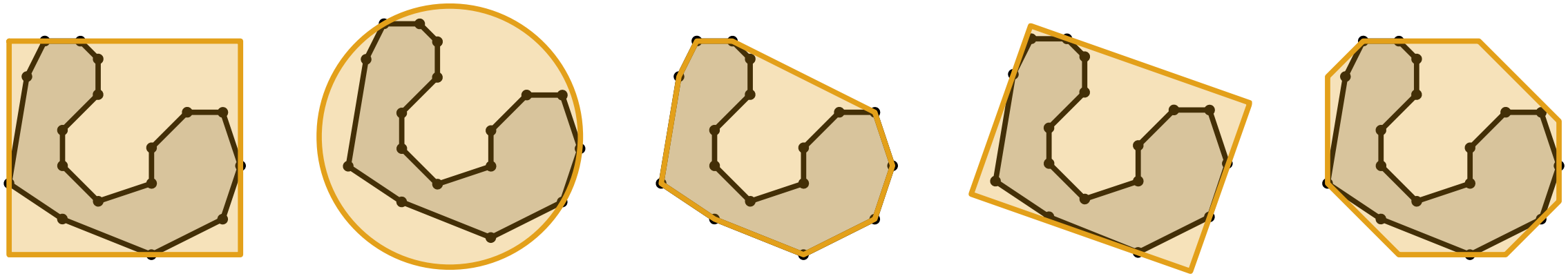
Bounding volumes



A Bounding volume is the smallest of a given shape/geometric object type that fully encloses another.

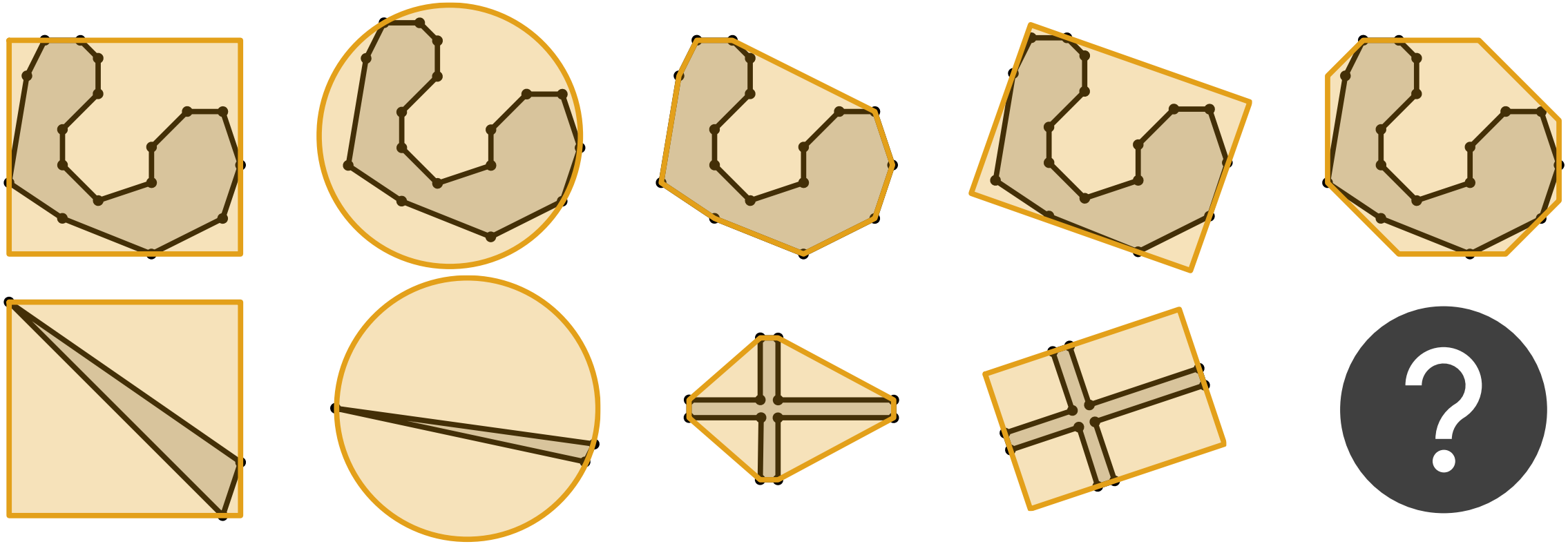
Can you think of types of bounding volumes that we've already encountered?

Bounding volumes

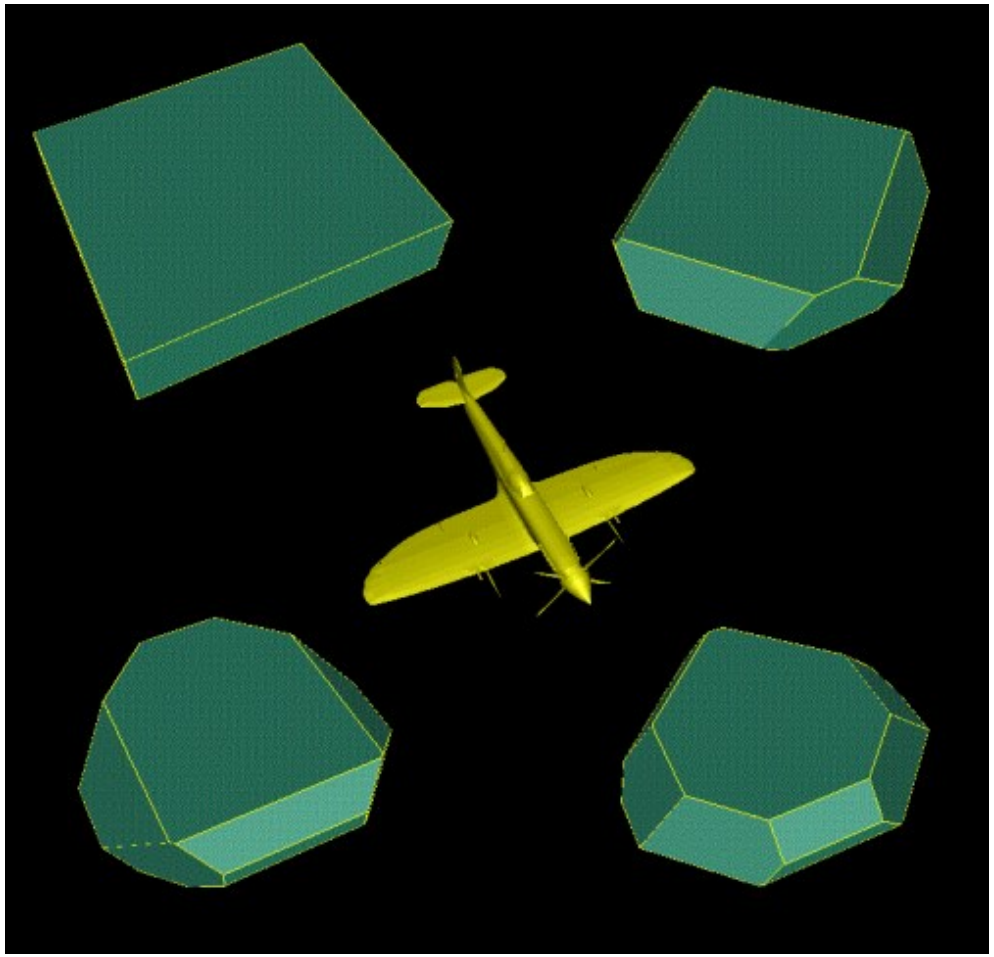


Bounding volumes

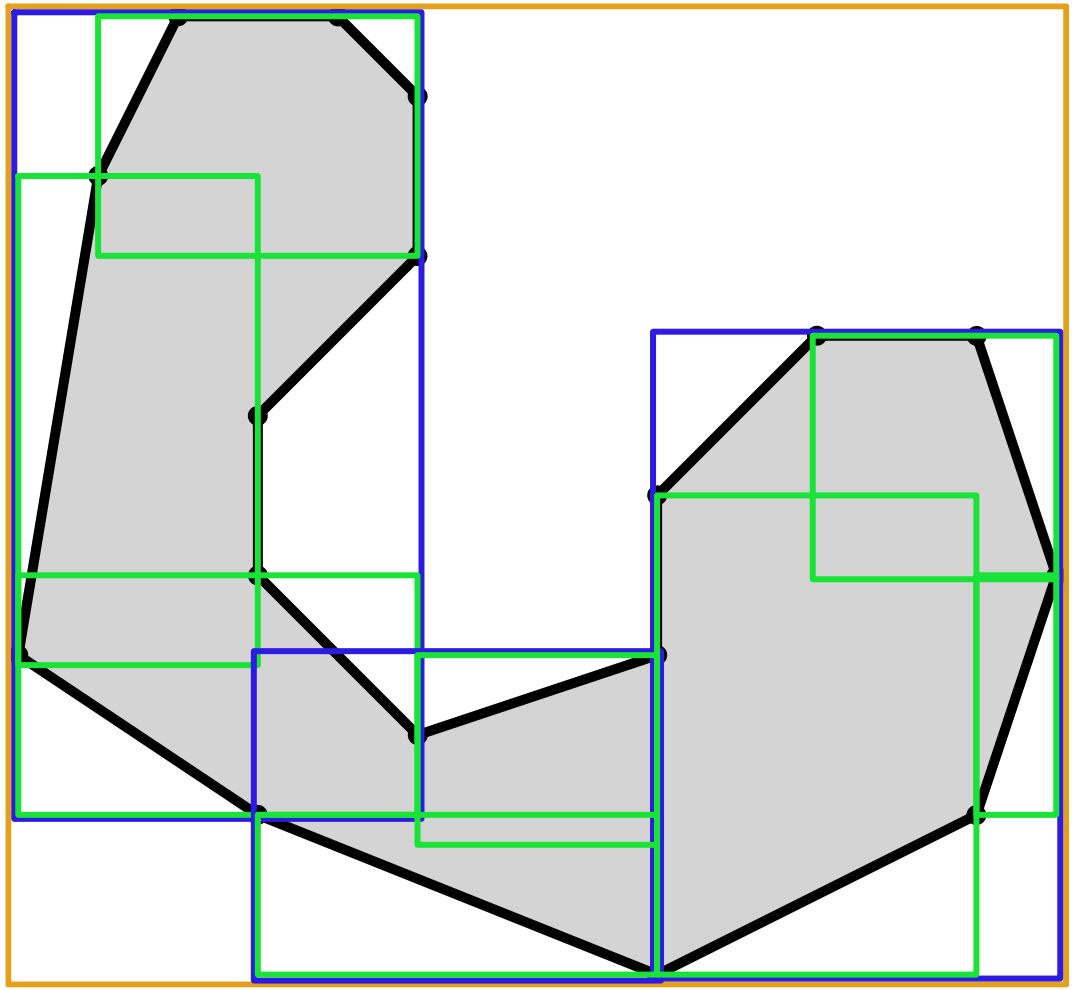
Some types of bounding volumes that we've already encountered!



k-DOPs

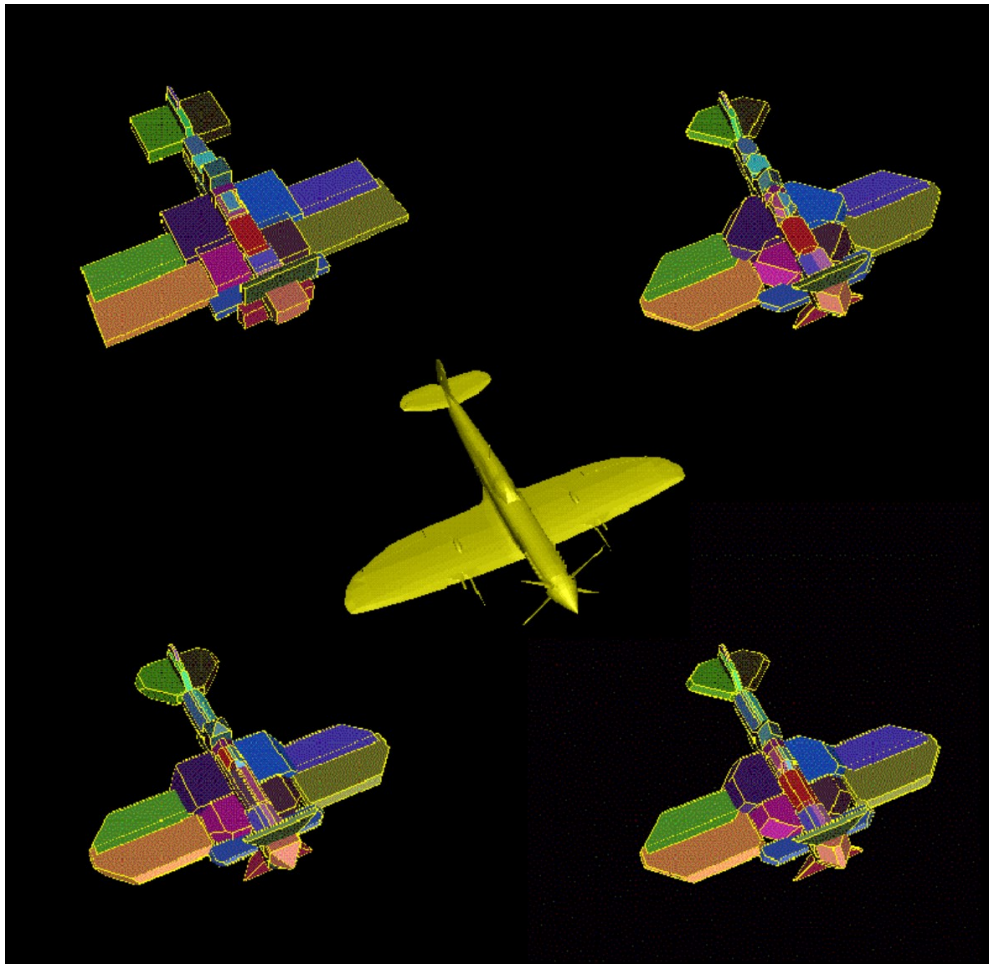


Bounding volume hierarchies – Primitives

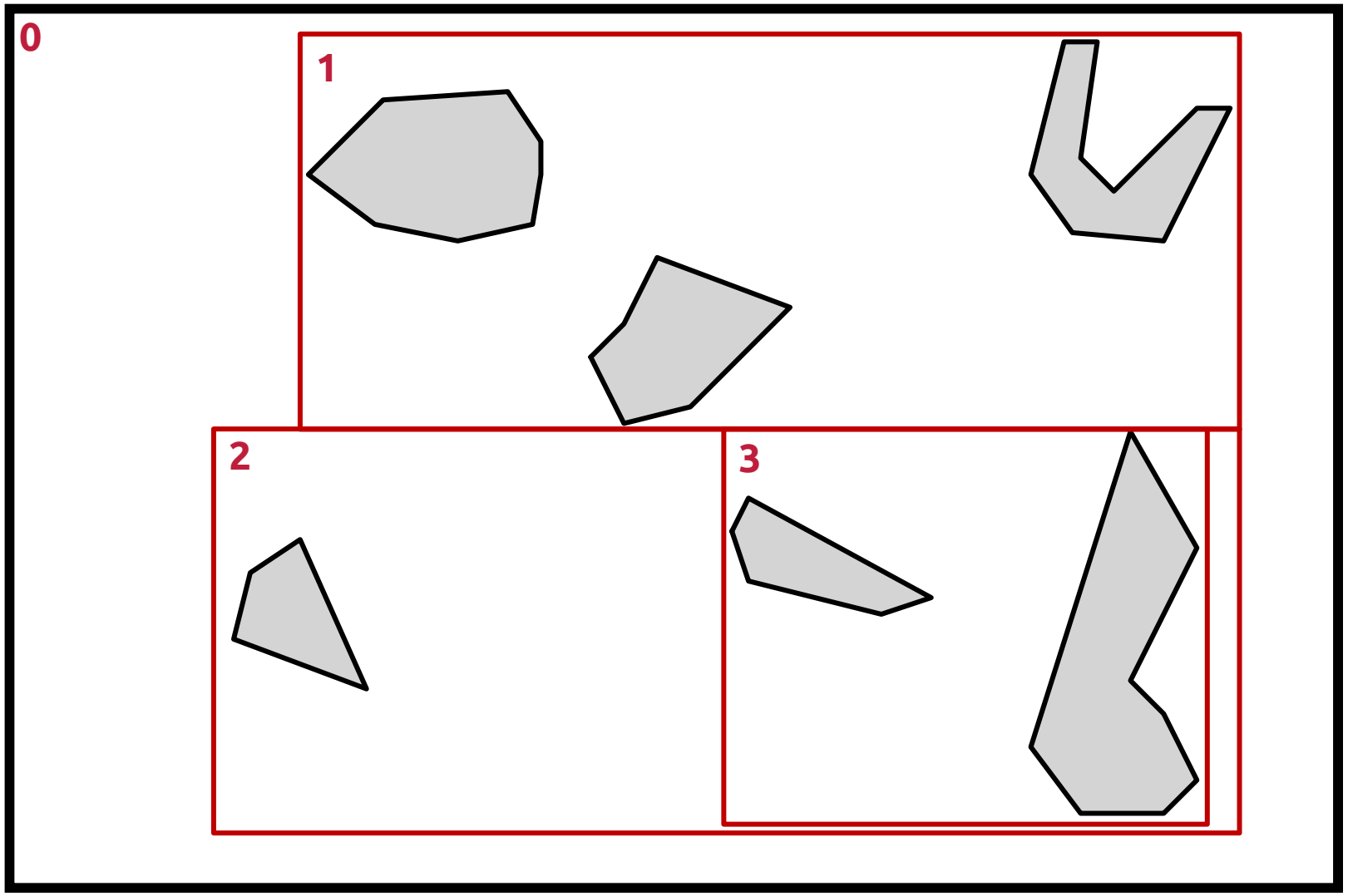


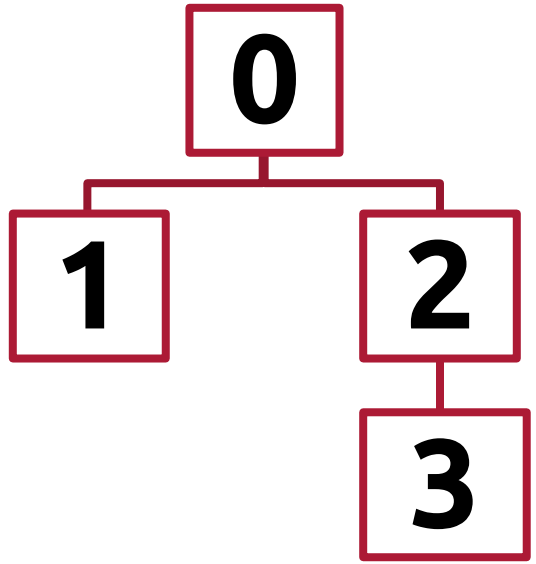
What do we have to do to ensure that this works?

Bounding volume hierarchies– k-DOP

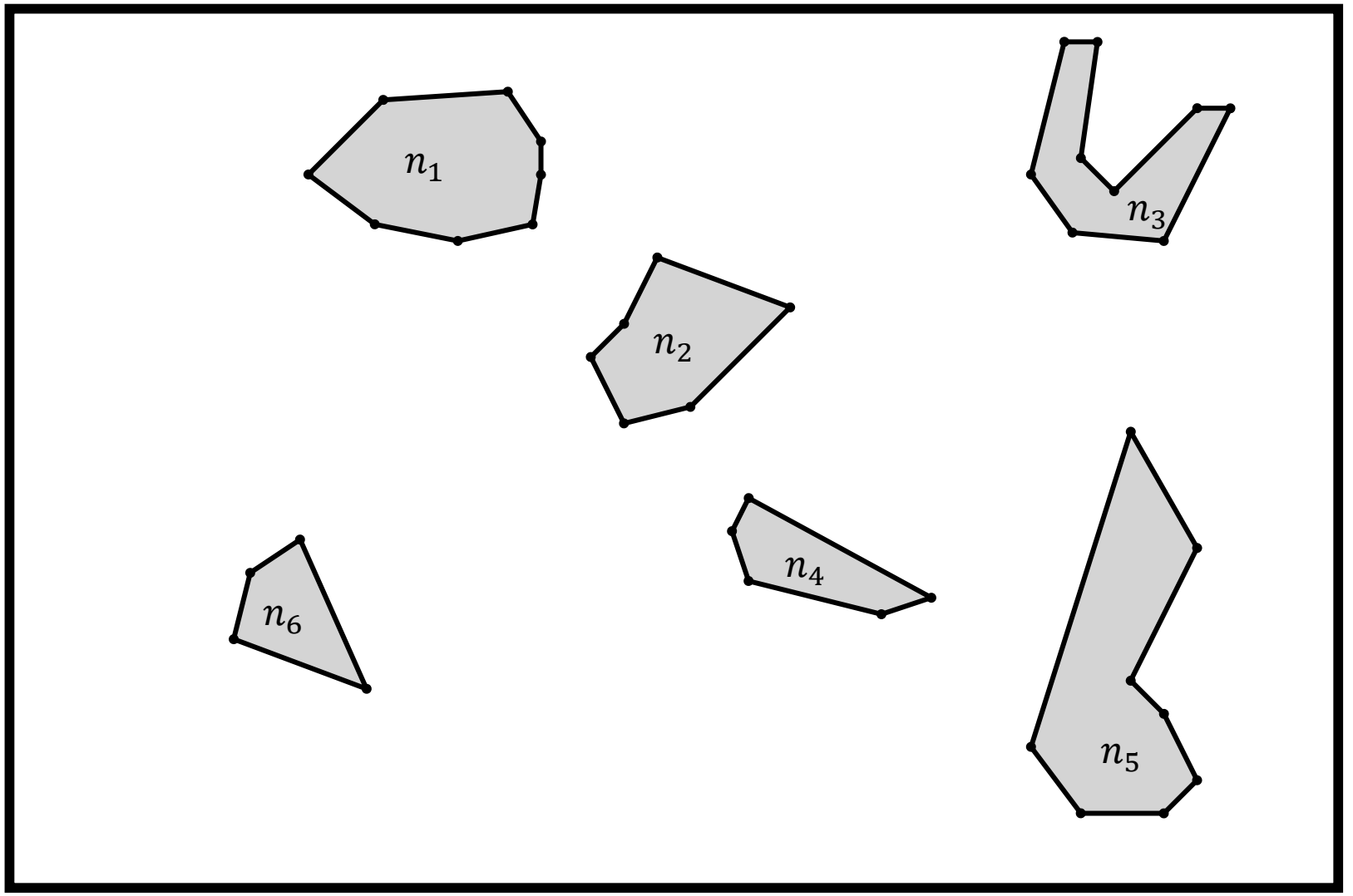


General idea – Bounding volume hierarchies

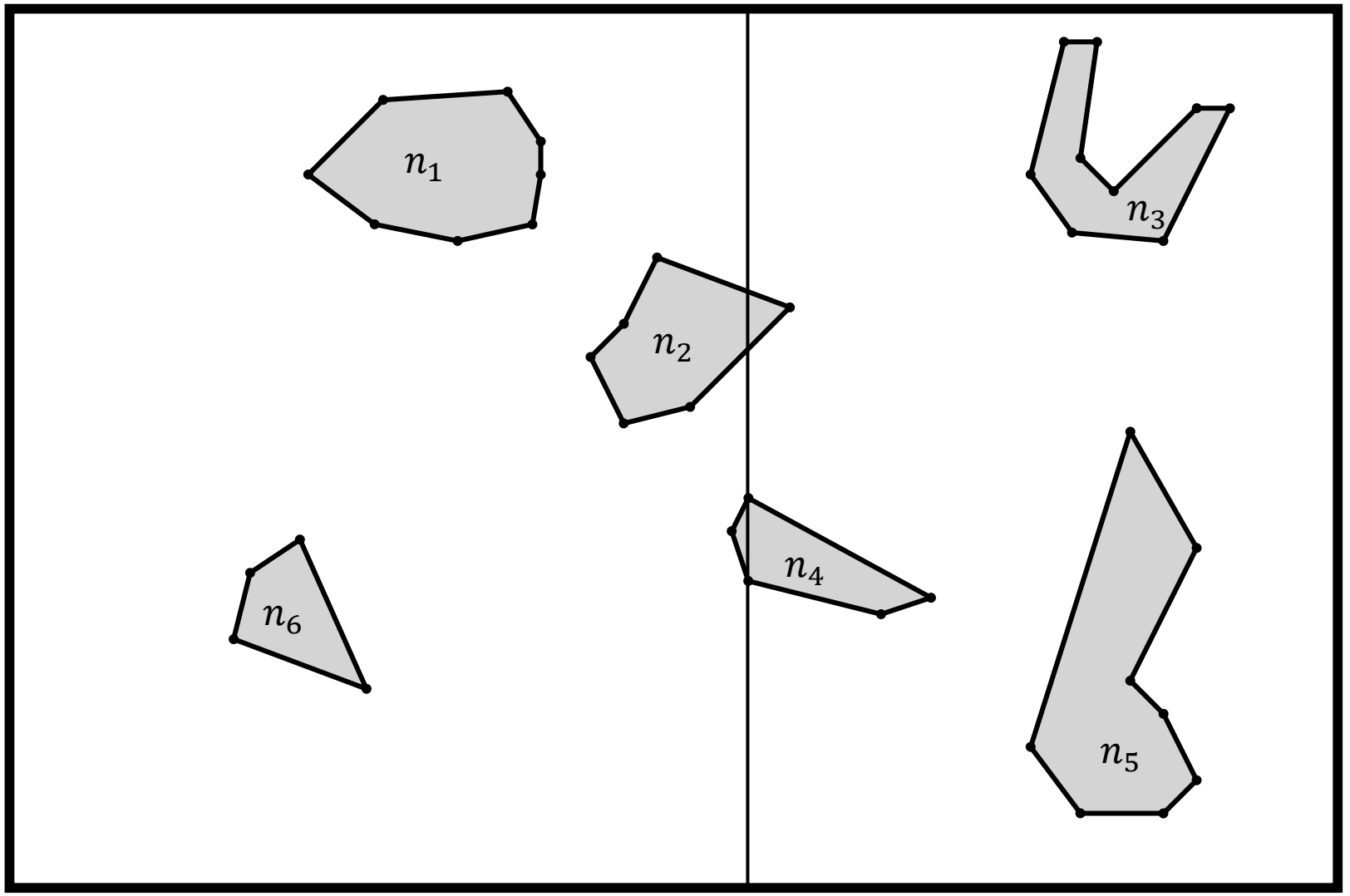




Bounding volume hierarchies – k-d-tree



Bounding volume Hierarchies – k-d-tree



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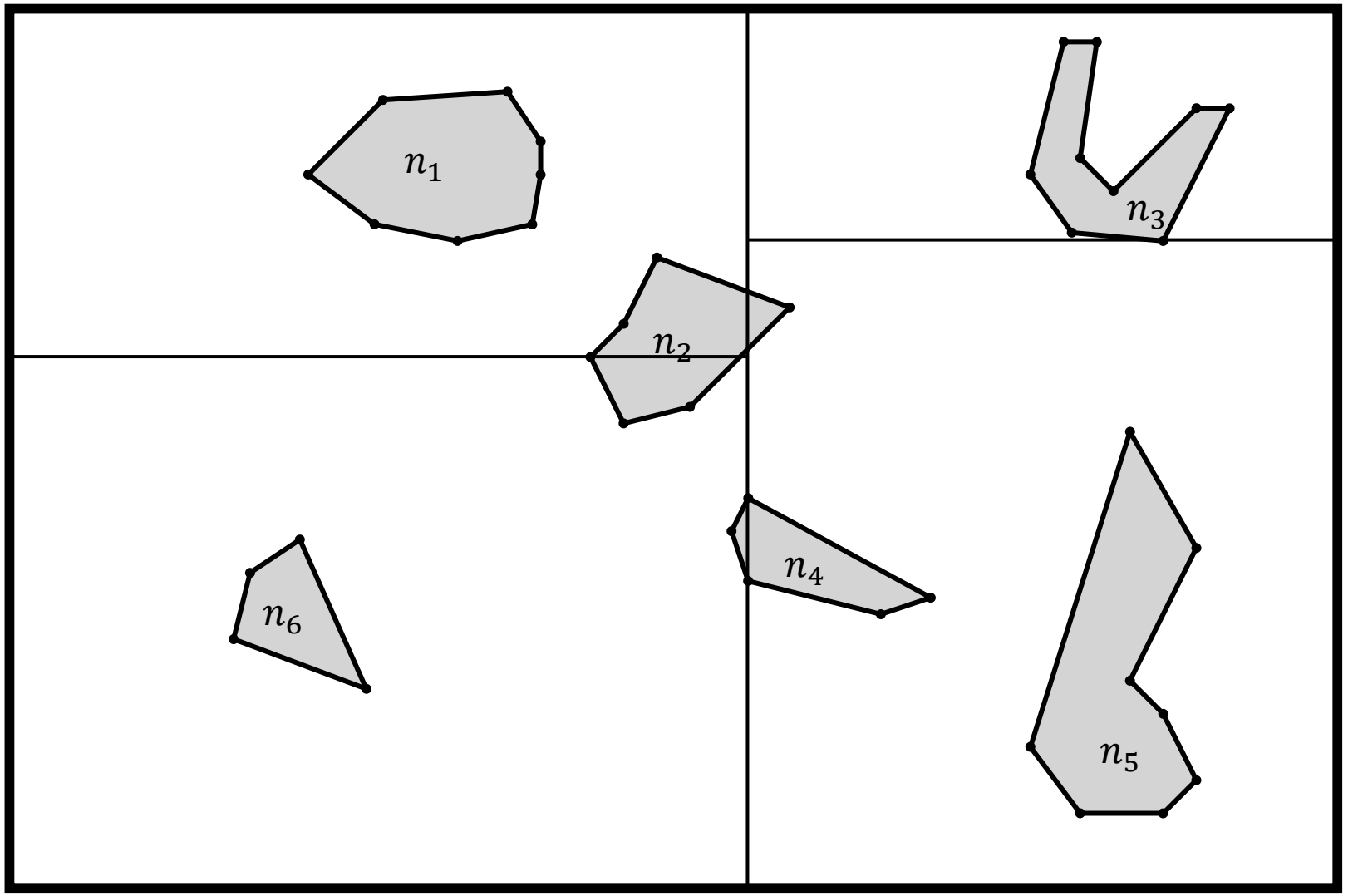

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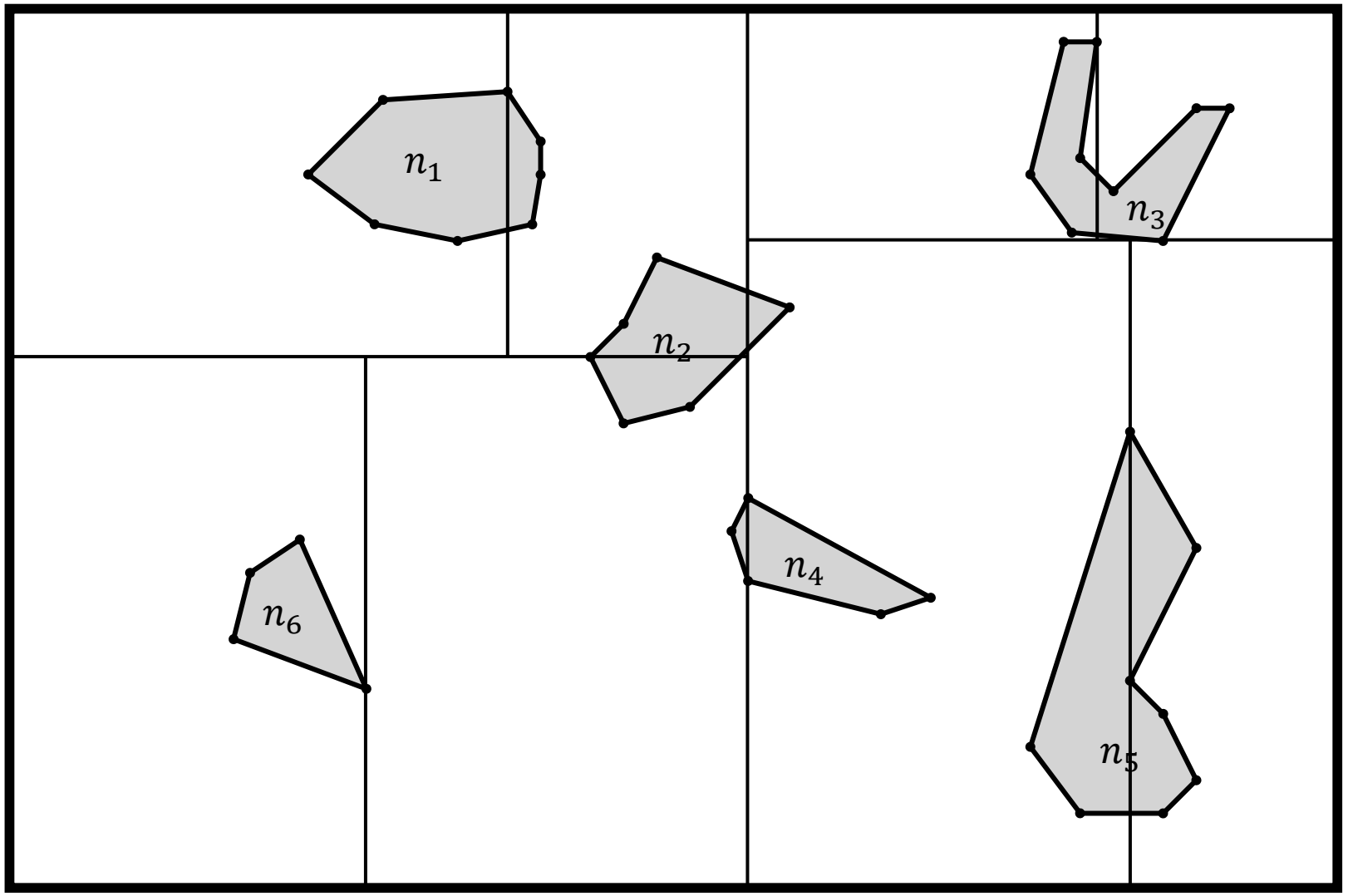
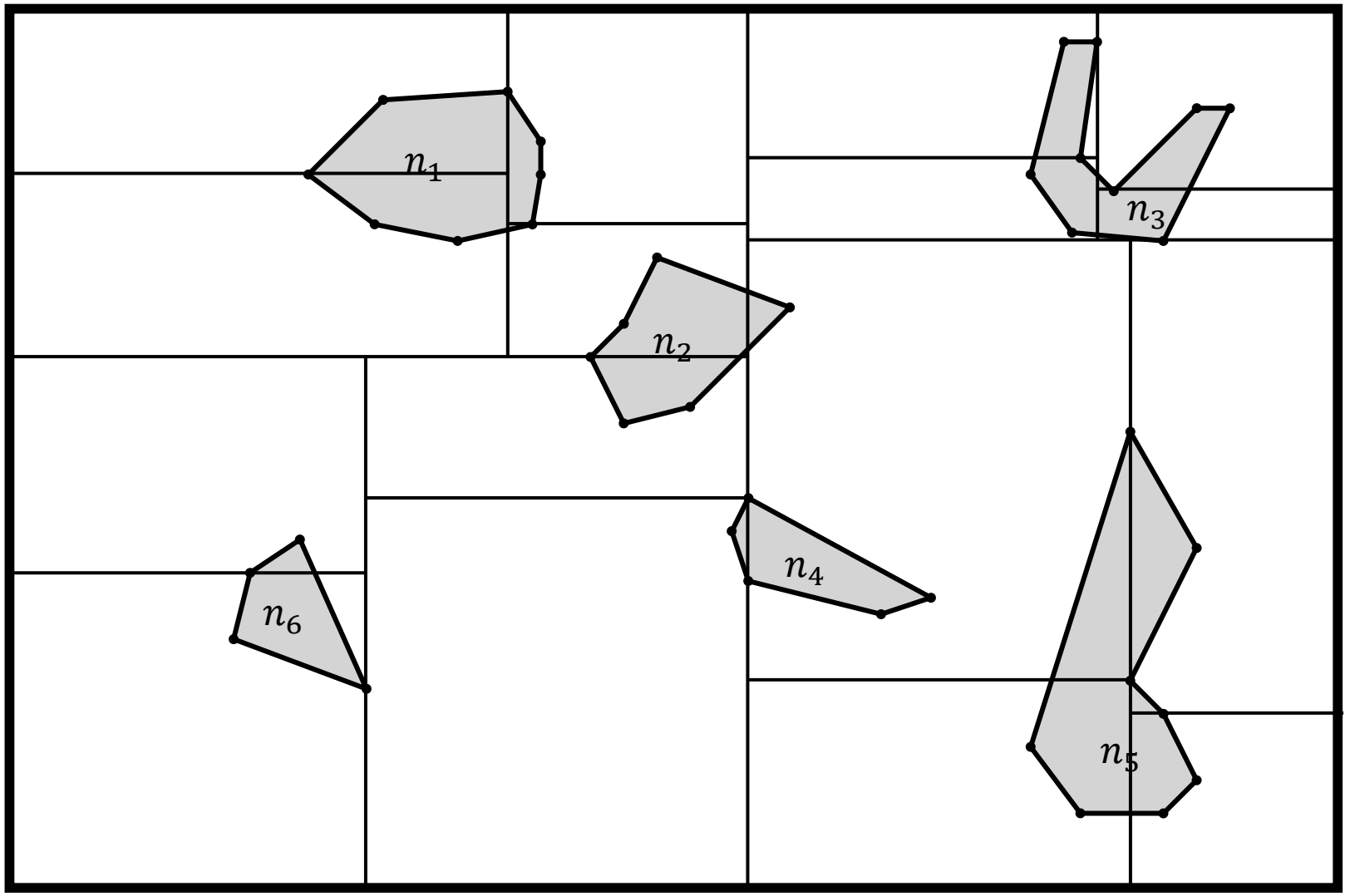


k-d-tree



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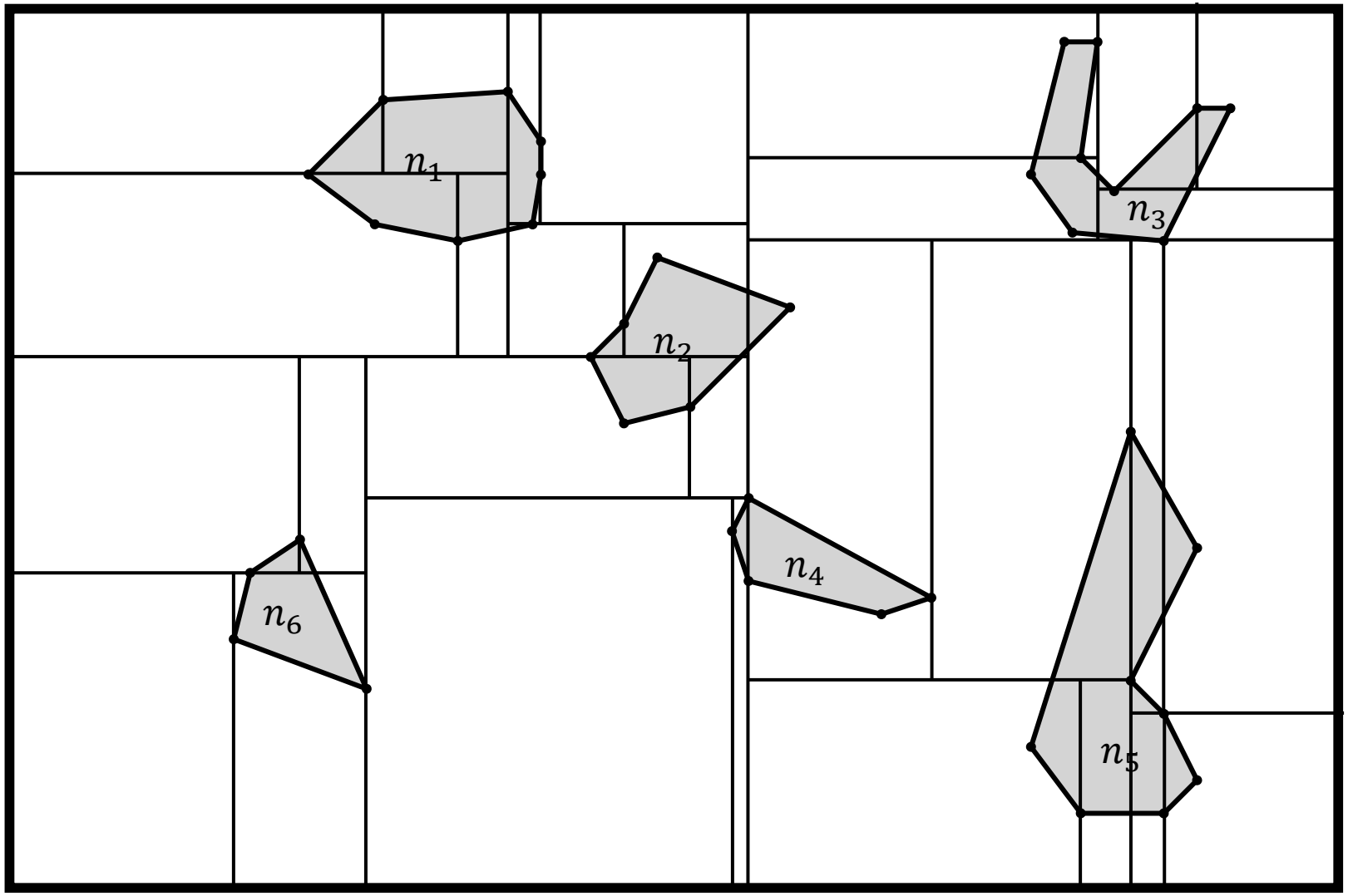

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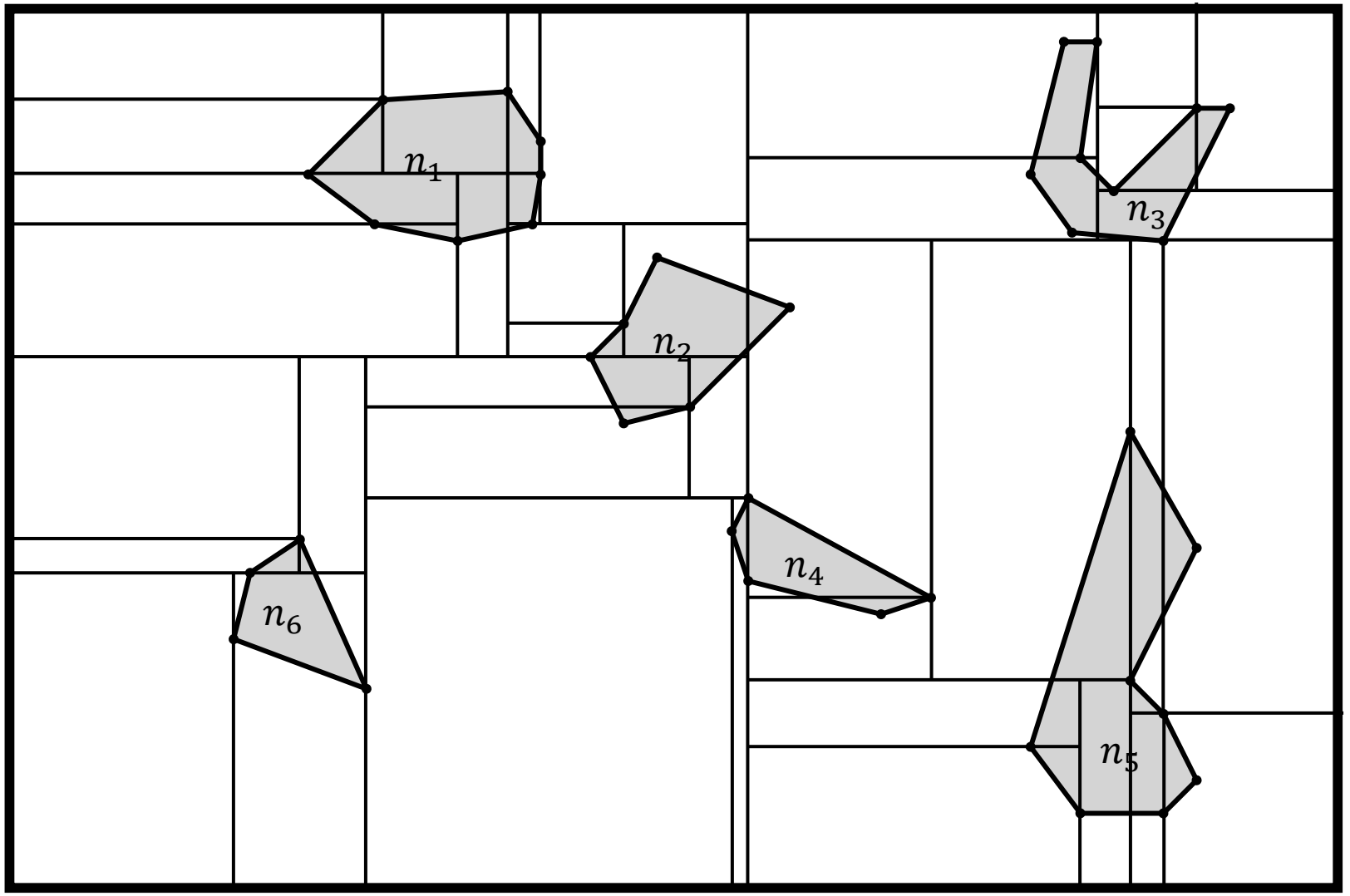

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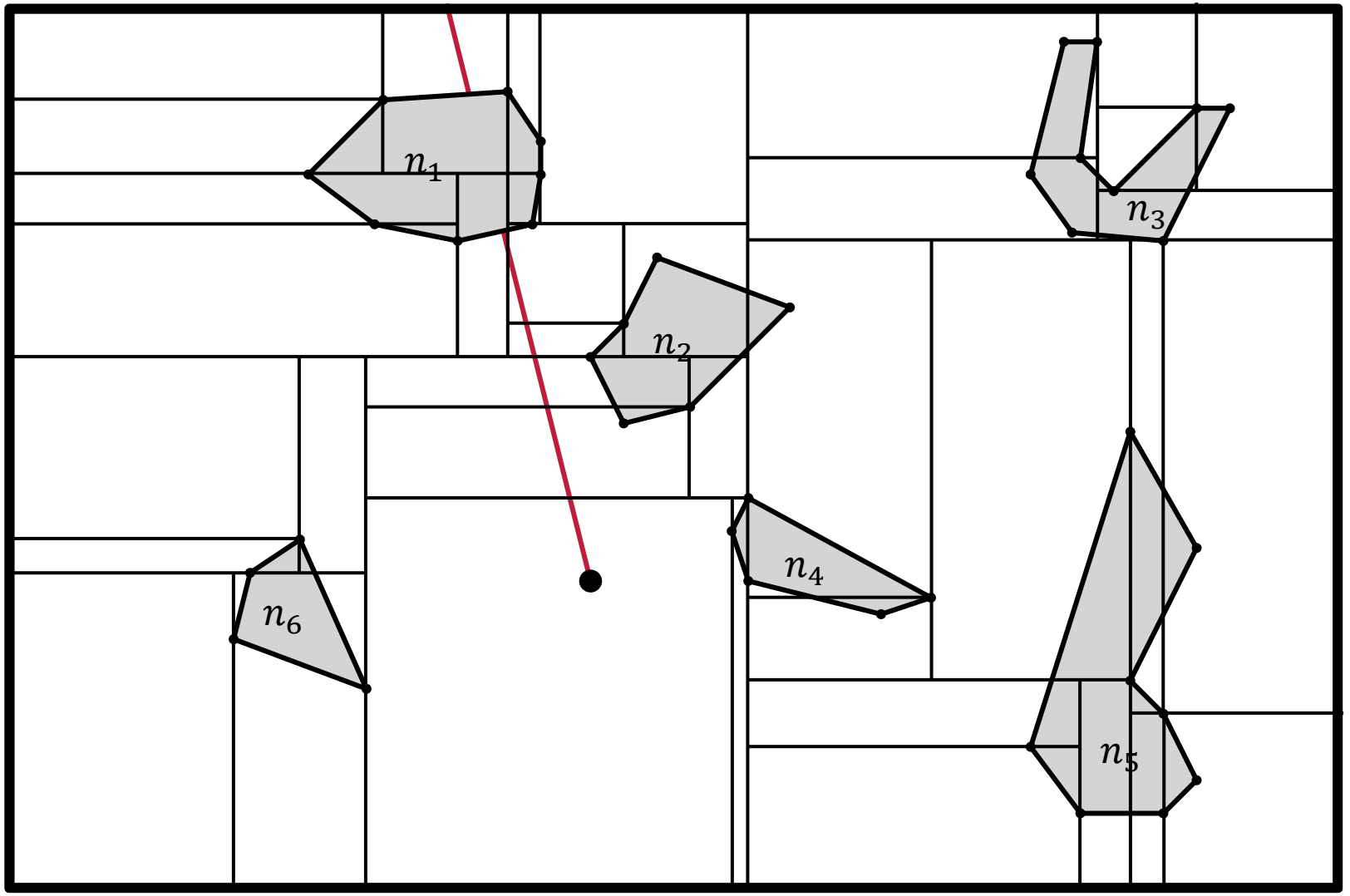

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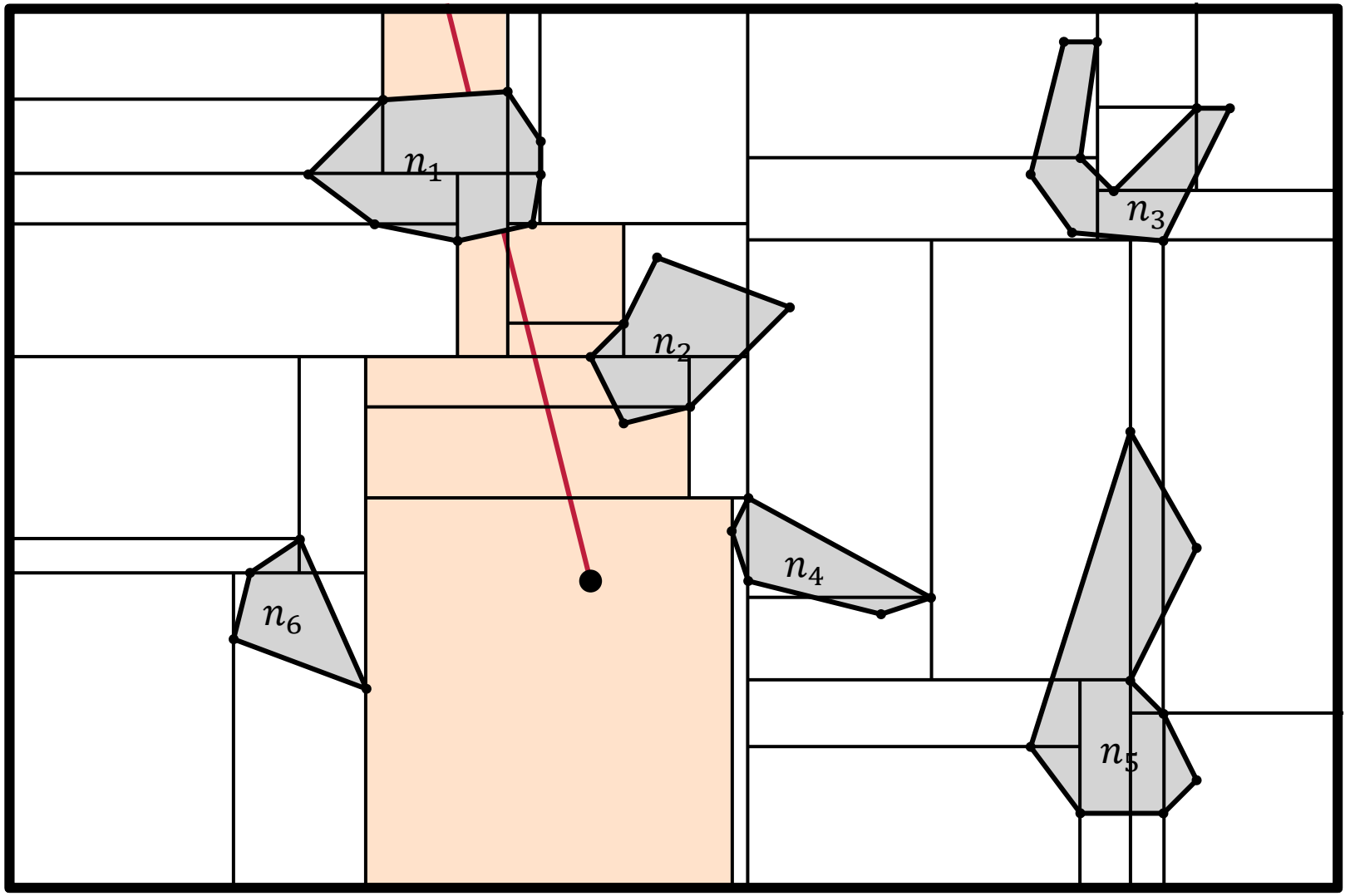

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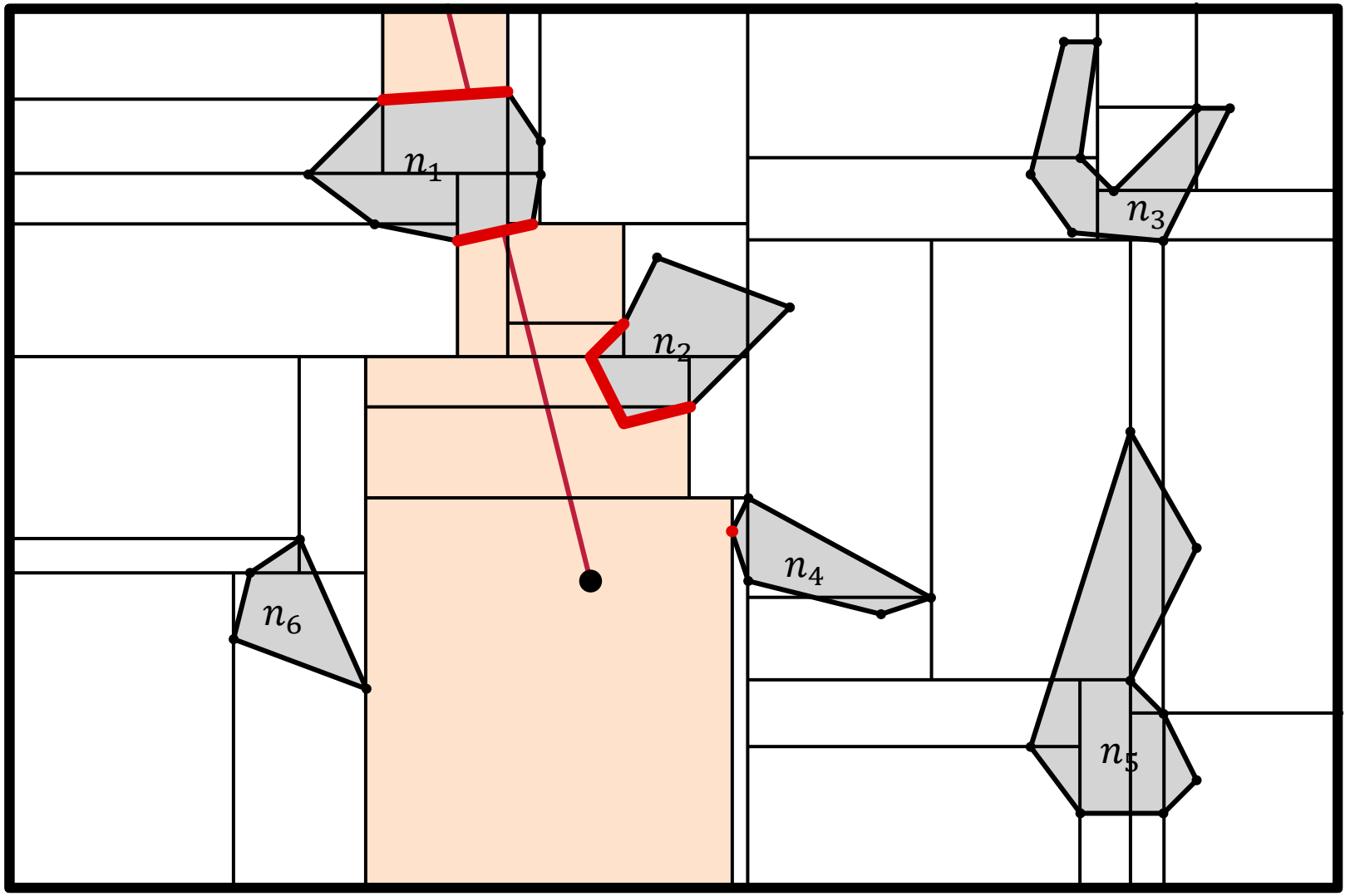
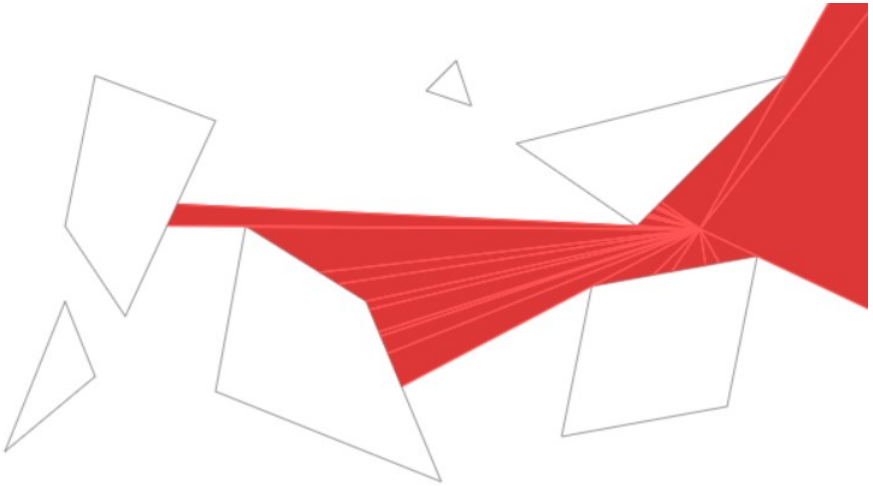
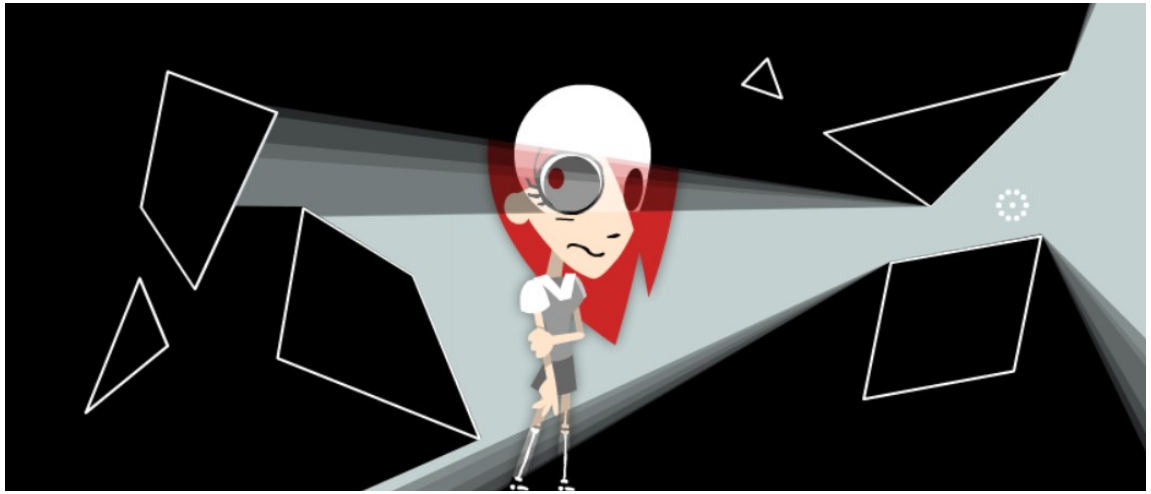


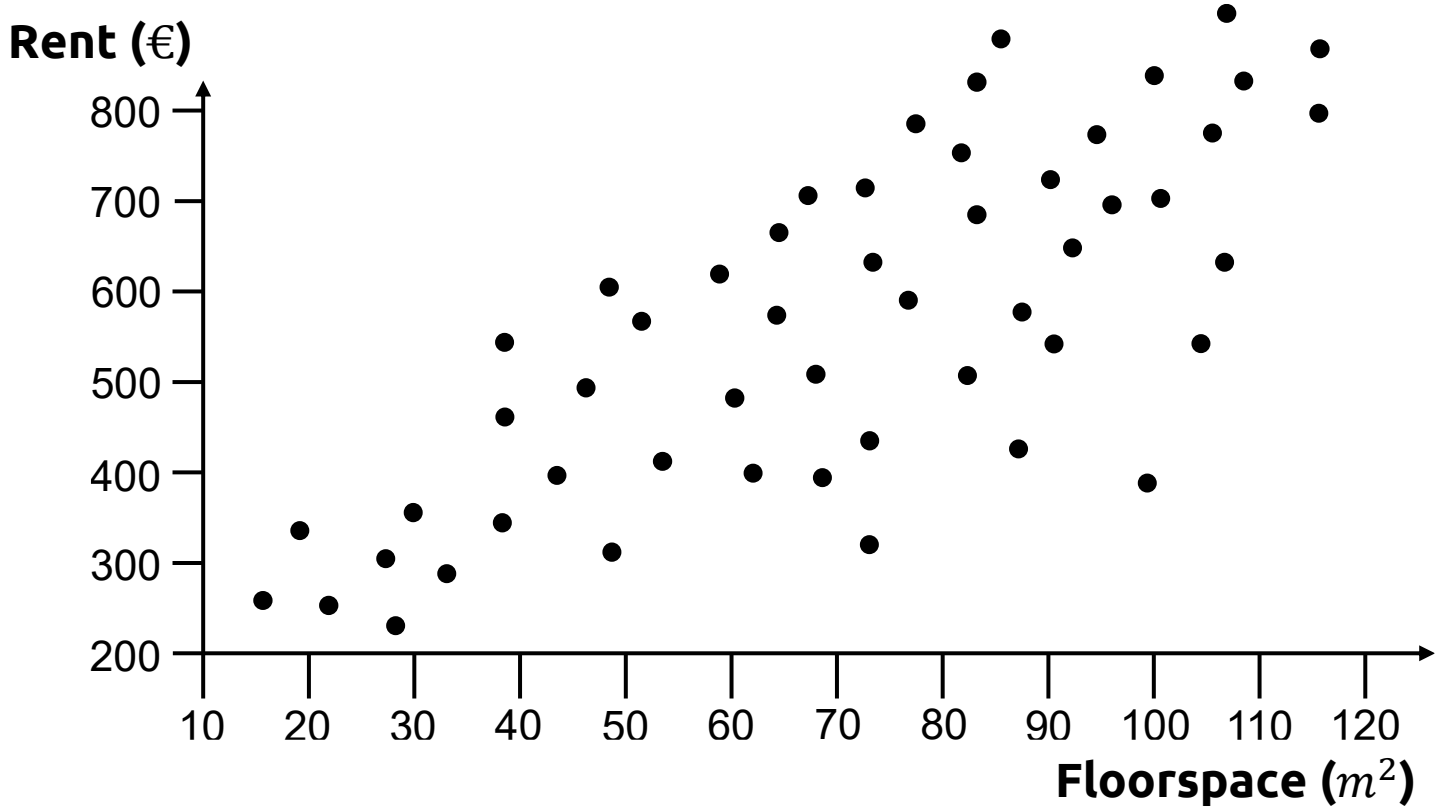
More applications in computer graphics





https://ncase.me/sight-and-light/

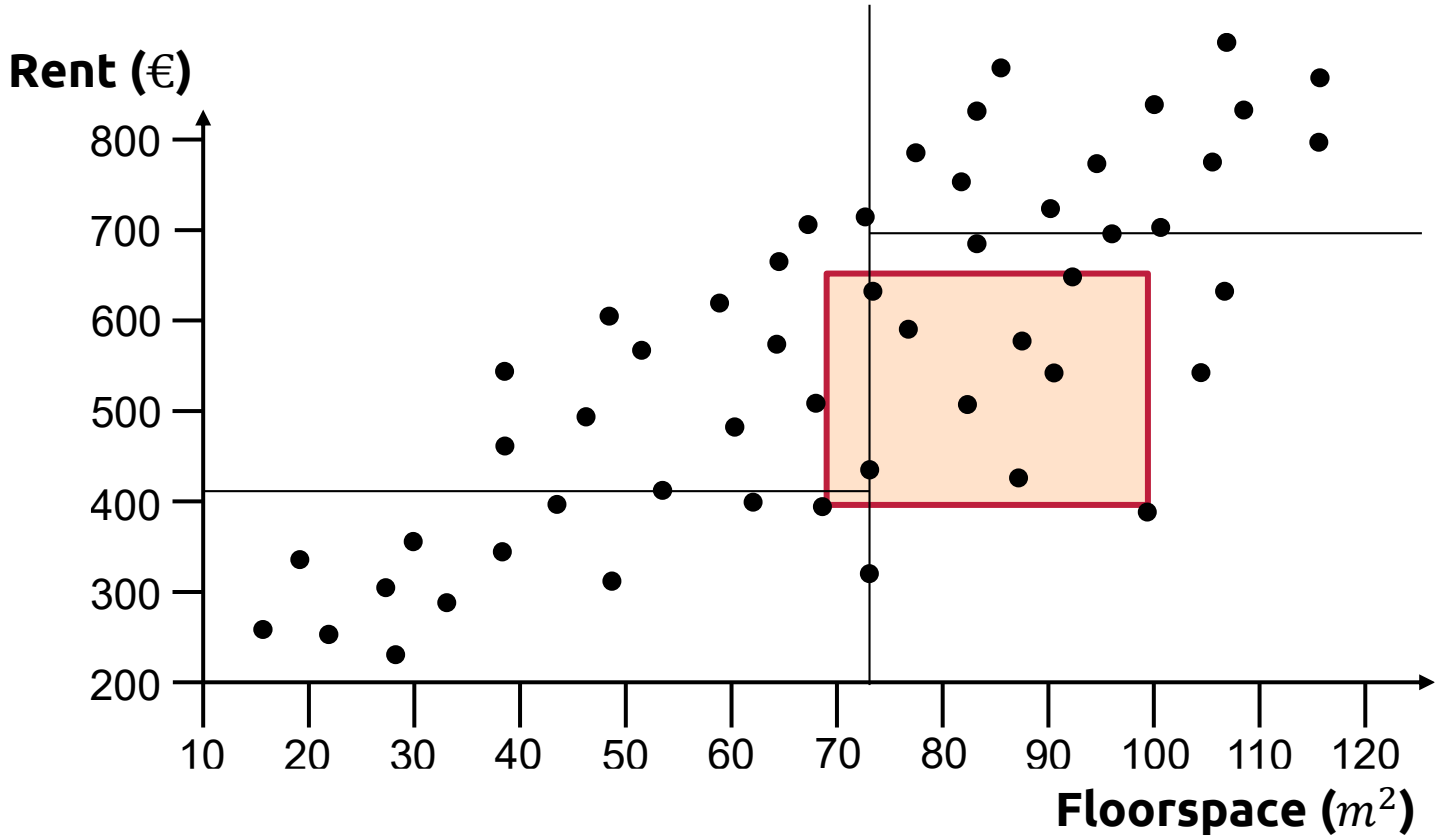
k-d-tree – Range search



Find an apartment with

- $400 - 650€$ **/ month**
- $70 - 100m^2$

k-d-tree – Range search



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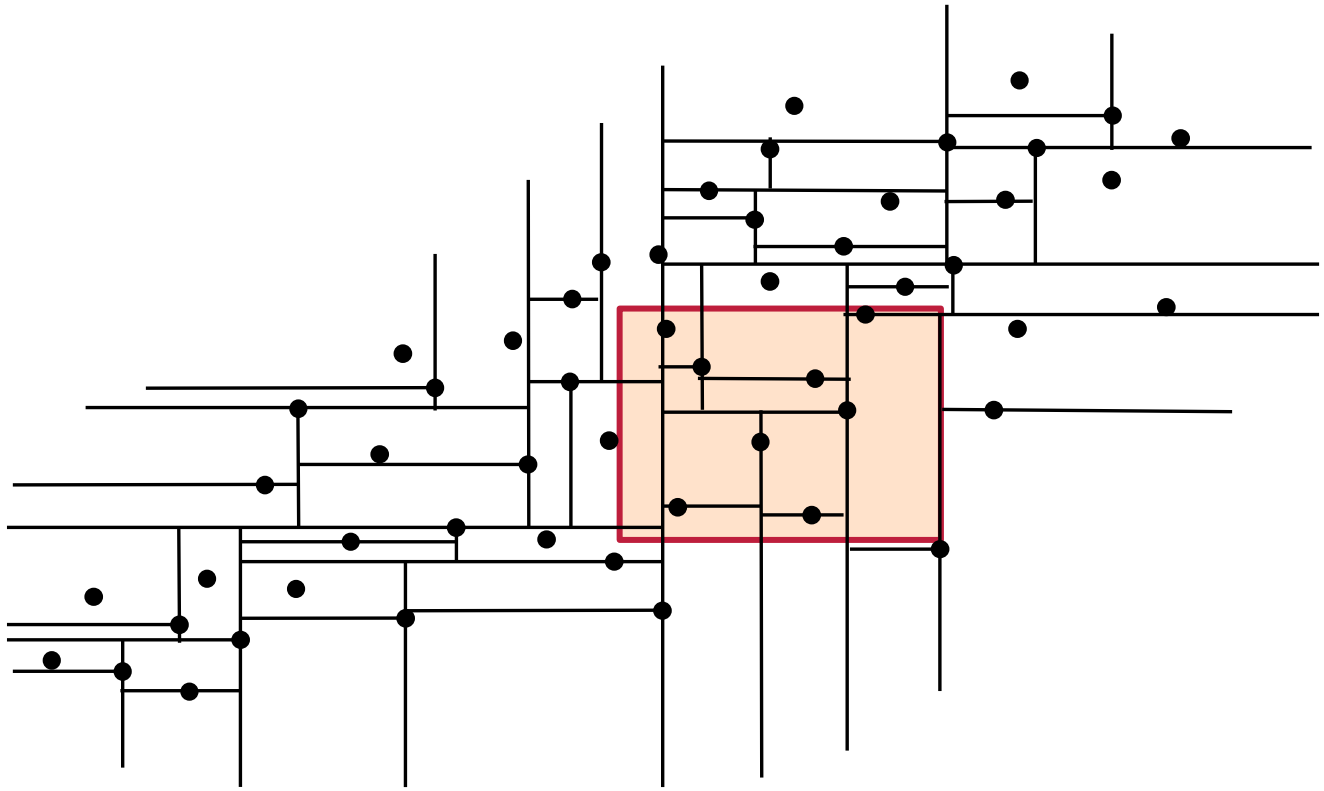

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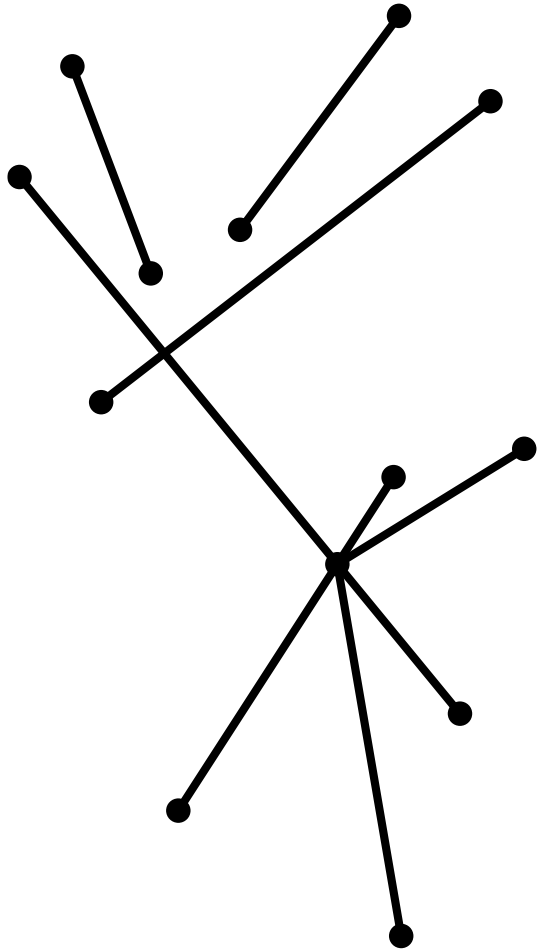
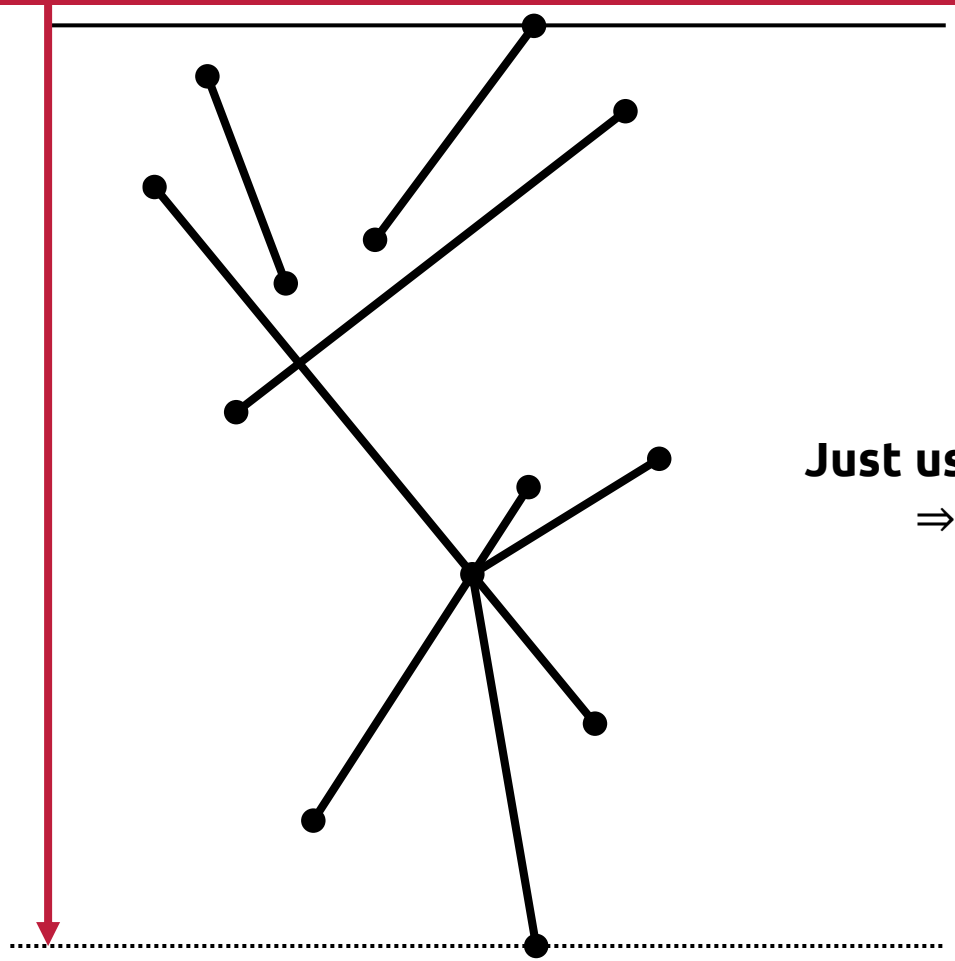
Line segment intersection – Ideas?



Multiple polygon intersection – Ideas?



Just use a sweep line!

$\Rightarrow O(n \log(n))$