

## Part Placement Problem

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The part placement problem is a classical problem in computational geometry. Given a certain background region and set of parts, our goal is to place as many parts as possible and minimize the amount of wasted space (i.e. parts of the region that cannot be used to place any additional parts due to size or shape constraints). This problem commonly appears in industries such as clothing or furniture manufacturing. Consider, for example, couch manufacturing. The factory will receive a set of leather hides of various shapes and sizes and will need to cut out as many couch pieces as possible. The factory will need to be able to input the dimensions of the leather hide, the set of pieces to be placed, and find a good, if not optimal, solution.

Of course, since this is a very popular problem, there are already many existing solutions. Our goal is to take a novel approach by discretizing the boundaries of both the background and the parts and considering the optimal placement relative to only a certain length along these boundaries. Naturally, there is much more to determining a good placement than just the orientation relative to certain section of the part, but the details are left to a more exhaustive report.

The following figures represent a small sample of some of our results.

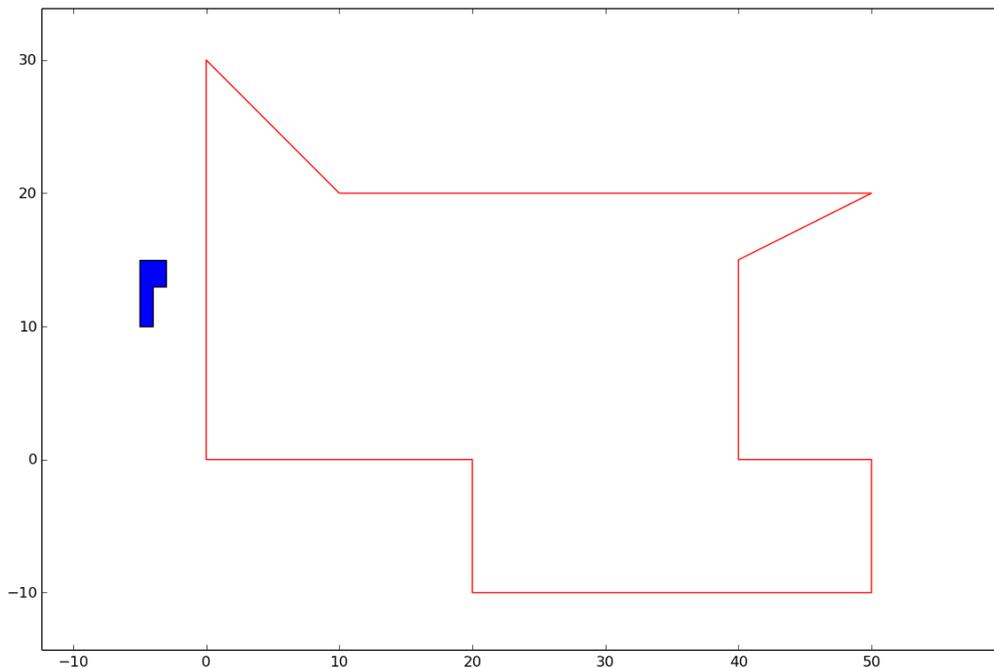


Figure 1.1:  
An example of a background and a  
part to be placed

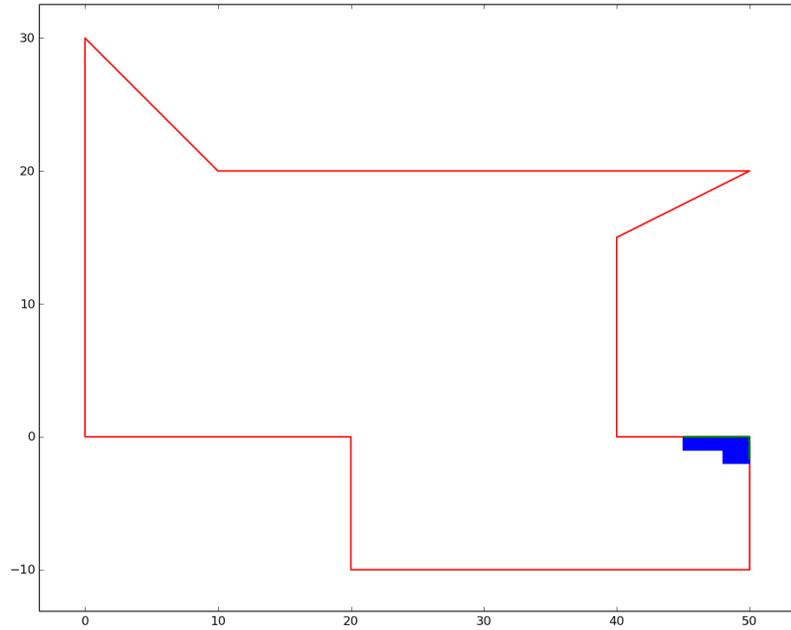


Figure 1.2:  
The optimal placement as  
determined by our algorithm.

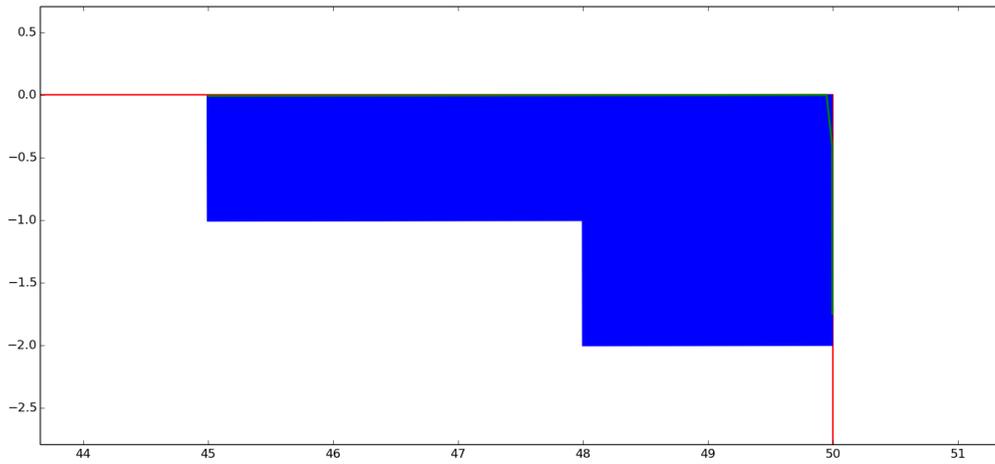


Figure 1.3:  
Zoomed-in view of placement in  
Figure 1.2

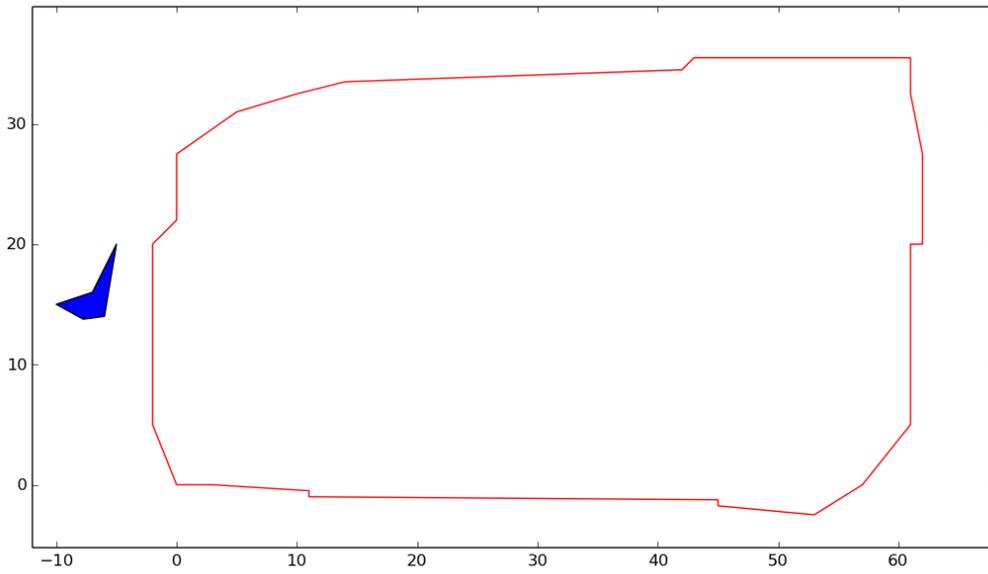


Figure 2.1:  
Another (more complicated) example of  
a background and a part to be placed.

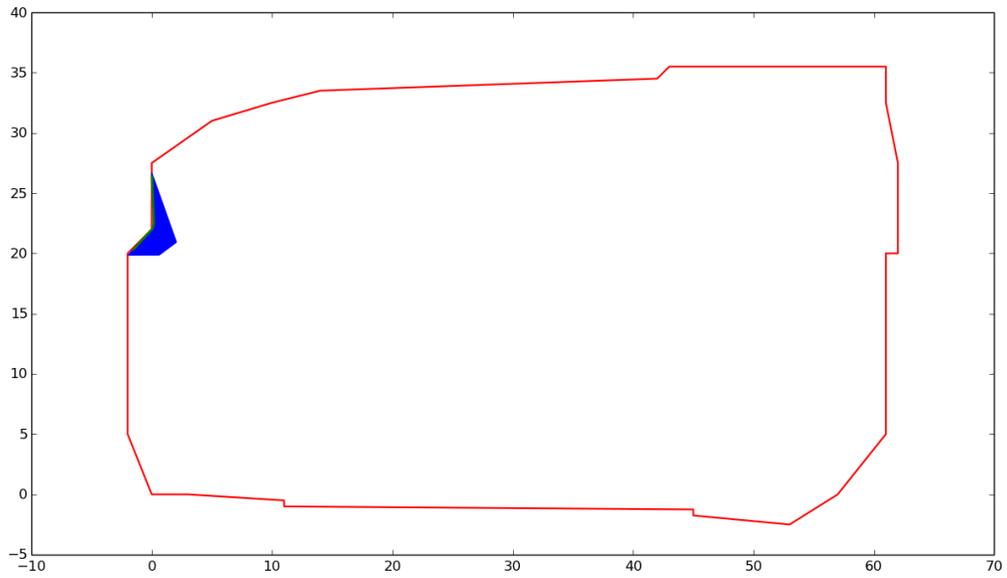


Figure 2.2:  
Good placement as determined by  
our algorithm.

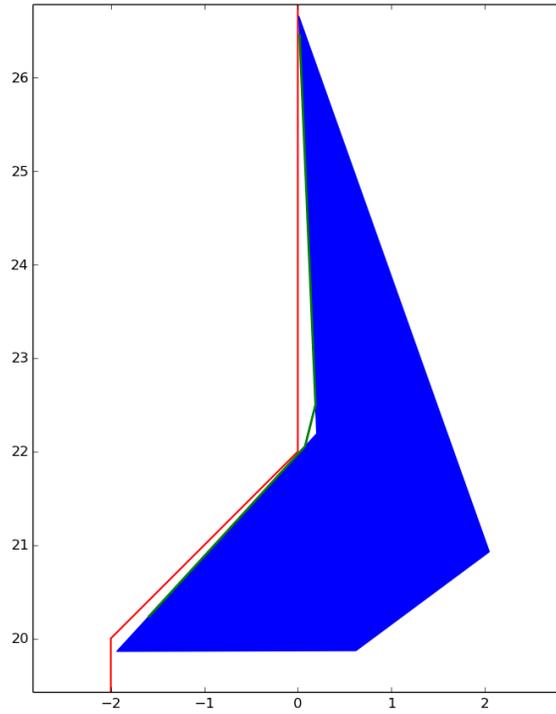


Figure 2.3:  
Zoomed-in view of placement in Figure 2.2. Note how the part does not have to be perfectly flush with the boundary to be considered a good placement.