

This document contains an illustration of a simple $O(n \log n)$ algorithm for computing the convex hull of a set of points in the plane, followed by two examples how a floating-point based implementation of this algorithm fails. The algorithm and the two failures are explained in detail in

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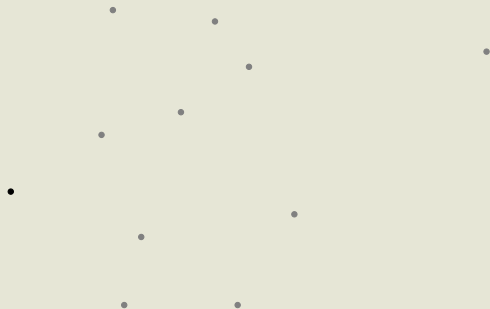
Another Classroom Example of Robustness Problems in Planar Convex Hull Computation.

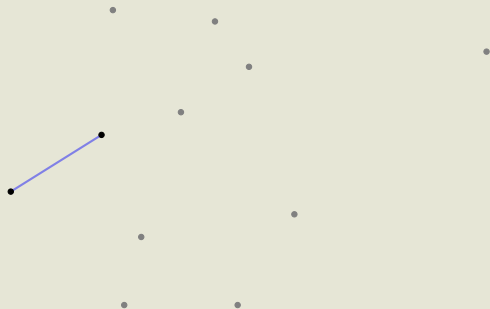
This document may be obtained from

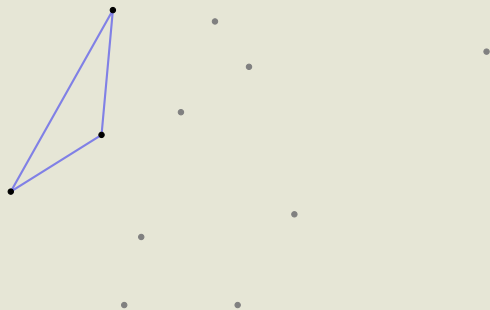
<http://www.isg.cs.uni-magdeburg.de/ag/ClassroomExample/>

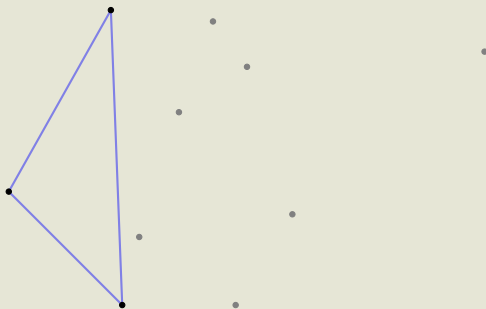
Planar Convex Hull Computation

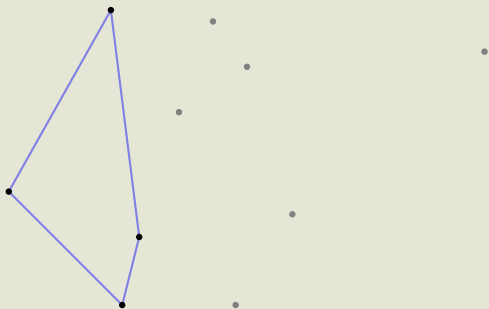


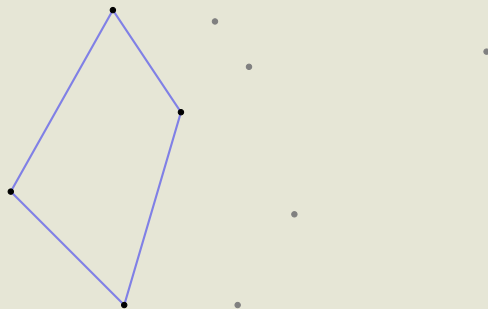


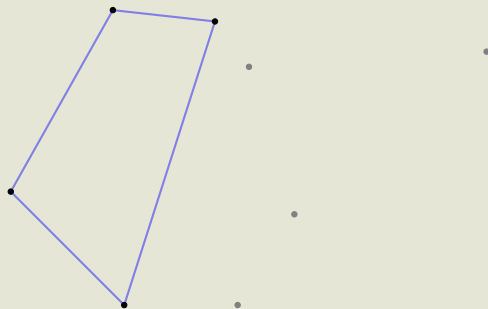


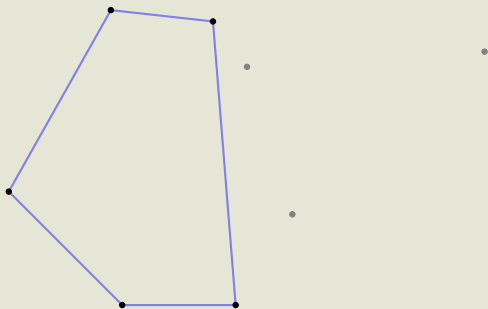


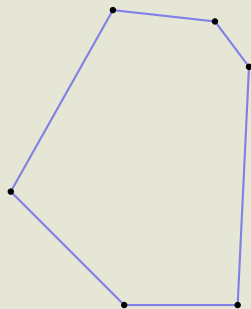


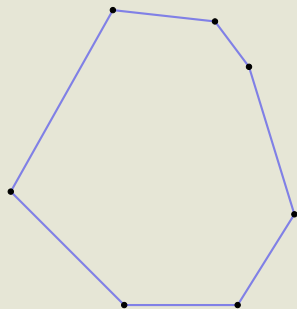


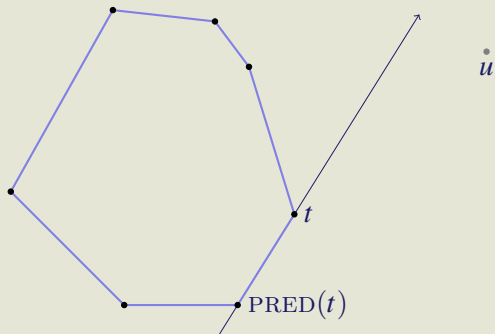


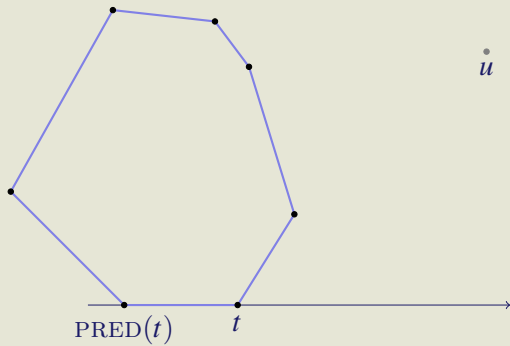


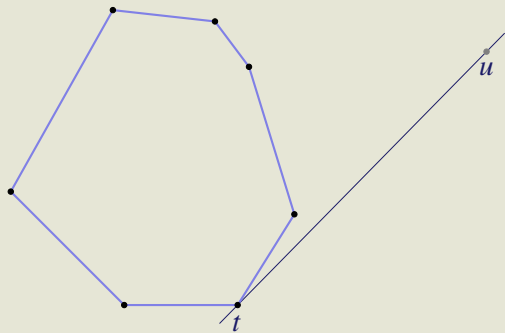


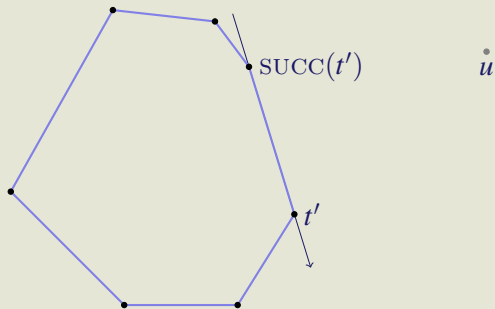


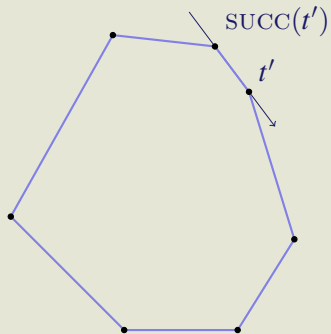




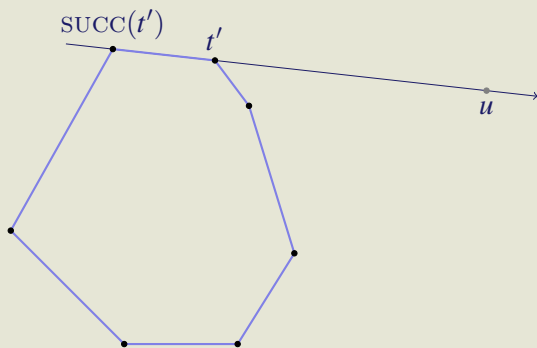


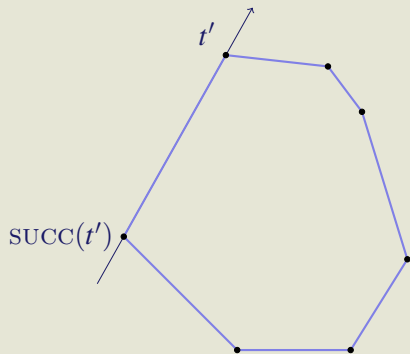




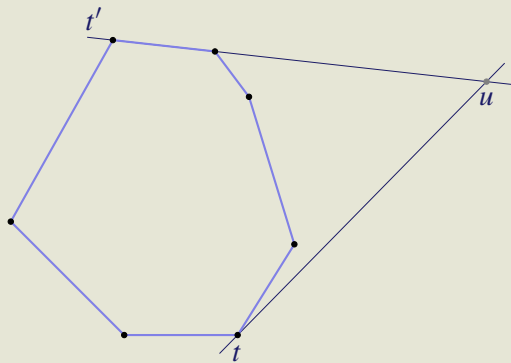


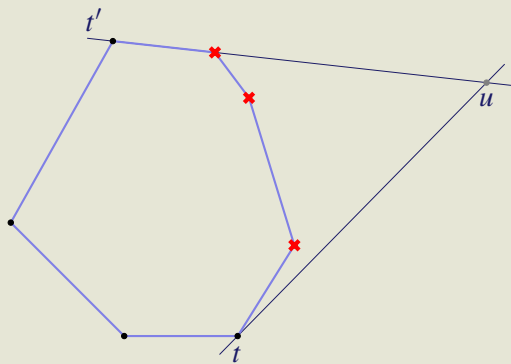
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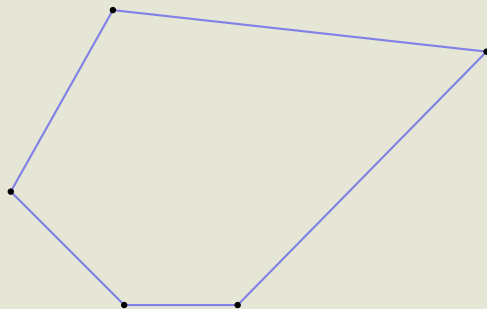




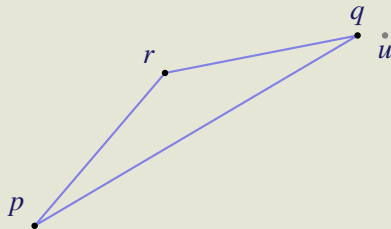
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How It Fails I

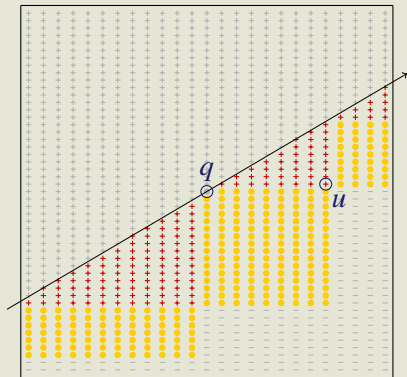
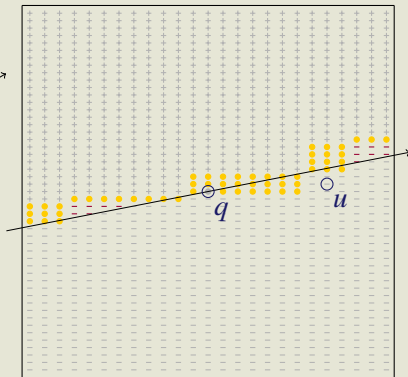


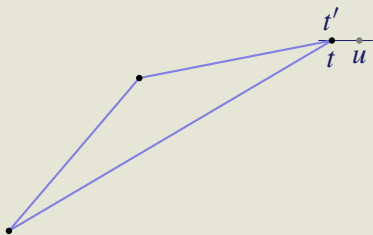
$$p = (-10.04094770362331879, -7.506293383338360492)$$

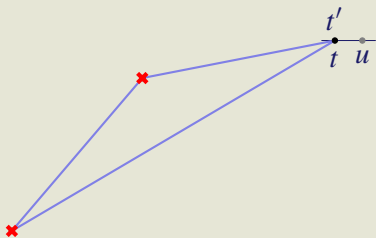
$$q = (1.056089924324703055, -0.9655180522057801307)$$

$$r = (-5.5608992432470305545, -2.255180522057801307)$$

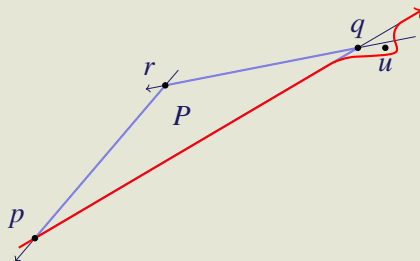
$$u = (1.0560899243247048318, -0.9655180522057800196)$$


 $\ell(p, q)$

 $\ell(r, q)$



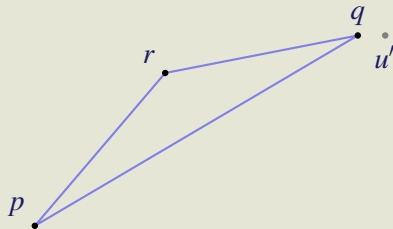






Inconsistency: since we process points in sorted order we know $u \notin P$, but one incorrect orientation test places u inside P .

How It Fails II

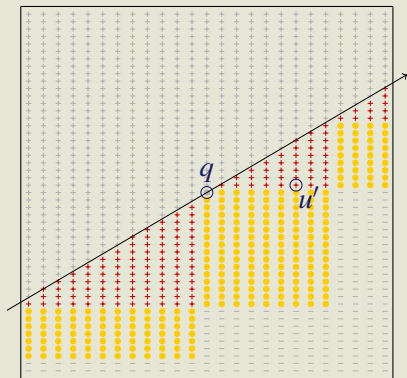
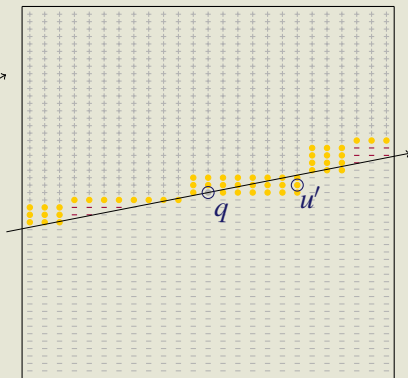


$$p = (-10.04094770362331879, -7.506293383338360492)$$

$$q = (1.056089924324703055, -0.9655180522057801307)$$

$$r = (-5.5608992432470305545, -2.255180522057801307)$$

$$u' = (1.0560899243247043877, -0.9655180522057800196)$$


 $\ell(p, q)$

 $\ell(r, q)$

