

Homework 1

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Problem 1

Some sort of binary search.

Jointly search P and P' Pick $a \in P$, $b \in P'$ Want line with highest z intercept

Idea: $O(n)$ run Graham's Scan on it. Already sorted so takes $O(n)$ time.

Idea: Start at a compute point $b \in P'$ tangent to a ($O(\log n)$). Then reverse, find a tangent to b . Then forward, find b tangent to a . Then done????

Algorithm 1 Tangent Function

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1: function TANGENT( $a, P$ )
2:   Binary search to find point of tangency
3:    $low \leftarrow 0$ 
4:    $high \leftarrow |P|$ 
5:   while !found do
6:      $m \leftarrow \lceil (low + high)/2 \rceil$ 
7:      $line \leftarrow \overrightarrow{a, m}$ 
8:     if  $line([m+1]_x) > [m+1]_y$  and  $line([m-1]_x) > [m-1]_y$  then
9:       found it (is supporting line)
10:      return  $m$ 
11:     else if  $line([m+1]_x) > [m+1]_y$  then
12:       line intersects some point before  $m$  (tangent point to left)
13:        $high \leftarrow m - 1$ 
14:     else if  $line([m-1]_x) > [m-1]_y$  then
15:       line intersects some point after  $m$  (tangent point to right)
16:        $low \leftarrow m + 1$ 
17:     end if
18:   end while
19: end function

1: function UPPERTANGENT( $P, P'$ )
2:   Run Tangent 3 times to find upper tangent.
3:    $a \leftarrow |P|/2$  // Random point in  $P$ 
4:    $b \leftarrow Tangent(a, P')$  // So we can 'see'  $p_i$  from  $b$ 
5:    $a \leftarrow Tangent(b, P)$  // Finds  $p_i$ 
6:    $b \leftarrow Tangent(a, P')$  // Finds  $p_j$ 
7:   return  $\overrightarrow{a, b}$ 
8: end function

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