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ALGORITHMS

HW - 11

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Problem 1 - 33.2-4 (pg 1028) [Explained algorithm]

To determine whether an n-vertex polygon is simple in $O(n \lg n)$ time.

An 'n' vertex polygon $\langle p_0, P_1, \ldots, p_{n-1} \rangle$ is simple if and only if the only intersections of the segments $\overline{P_0 P_1}, \overline{P_1 P_2}, \ldots \overline{P_{n-1} P_0}$ of the boundary are between consecutive segments $\overline{P_i P_{i+1}}$ and $\overline{P_{i+1} P_{i+2}}$ at the point P_{i+1}. Basically, we run the usual ANY-SEGMENTS-INTERSECT algorithm on the segments which make up the boundary of the polygon, with the modification that if an intersection is found, we first check if it's an acceptable one. If so, we ignore it and proceed. Since we can check this in $O(1)$ time the run time is the same as ANY-SEGMENTS-INTERSECT, i.e $O(n \lg n)$ time.

Problem 2 - 33. 4-1 (pg 1043)

The flaw in the plan is very obvious, in perticular, when we select line 'l', we may be unable to perform an even split of the vertices

So, we don't necessarily have that both the left set of points & right set of points have fallen to roughly half. For example, suppose that the points are all arranged on a vertical line, then we recurse on the left set of points, we haven't reduced the problem size at all, let alone by a factor of two. There's also an issue in the setup that you may end up asking about the set ~~size~~ of size less than two when looking at the right set of points.

* INCREMENTAL - METHOD $(P_1, P_2, \ldots P_n)$

if $n \leq 3$ then
  return $(P_1, \ldots P_n)$
end if
Use merge sort to sort the points by increasing x-coordinate, breaking ties by requiring increasing y-coordinate.
Initialize a red-black tree 'C' of size 3 with entries P_1, P_2 & P_3.
for $i = 4$ to n do
  Let q be the result of binary searching for the first point of C_{i-1} such that $\overline{qP_i}$

doesn't intersect the interior of C_{i-1}.

Let q' be the result of binary searching for the last point of C_{i-1} such that $\overline{q'p_i}$ doesn't intersect the interior of C_{i-1}.

Delete $q+1, q+2, \ldots q'-1$ from C.

Insert p_i into 'C'.

end for.