

Prob. 1	Prob. 2	Prob. 3	Prob. 4

Problem 1.

Problem 2.

Problem 3.

Problem 4.

This problem is a simplification of *Convex Hull* problem because here we just need to traverse the points, no need to check if traversing is going clockwise or not. Algorithm is the following for n points:

- Find the initial point p_i which has *minimum* y , finding minimum of n points is bound by $O(n)$
- Sort the remaining points in ascending order according to polar angle that they made with p where it is bound by $O(n \log n)$ because we only spend $O(1)$ time for each polar angle calculation, in total, that results in $O(n)$ which is dominated by sorting n points.
- Traverse the points in the order and put an edge between the current point p_c and the following point p_f . Since we are traversing all points, this is $O(n)$.
- At the end, put one more edge between p_c and p_i to close the loop and create a polygon. This operation is just a constant time operation, $O(1)$.

In short, we have:

$$\begin{aligned} \text{Total Cost} &= \text{Find } p_i + \text{Calculate polar angles with } p_i + \text{Sort points} + \text{Close loop} \\ &= O(n) + O(n) + O(n \log n) + O(1) \leq O(n \log n) \end{aligned}$$