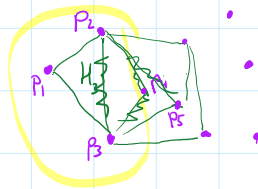


# INCREMENTAL ALGORITHM

**INPUT:** set  $S$  of points, given by coordinates in  $\mathbb{R}^2$

**OUTPUT:** list of points in  $\text{conv}(S)$ , in counterclockwise order

- PROCEDURE:**
1. sort  $S$  by  $x$ -coordinate:  $p_1, p_2, \dots, p_n$
  2. Take first 3 points  $p_1, p_2, p_3$ .  
Let  $H_3$  be these points in counterclockwise order



$$H_3 = \{p_1, p_3, p_2\}$$

$$H_4 = \{p_1, p_3, p_4, p_2\}$$

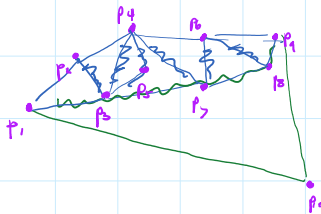
$$H_5 = \{p_1, p_3, p_5, p_2\}$$

3. For  $k=4, \dots, n$ :

Let  $H_k = \text{conv}(H_{k-1} \cup p_k)$ , in CCW order

How to do this, precisely?

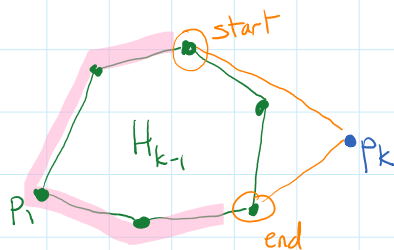
4. Return  $H_n$ .



$$H_9 = \{p_1, p_3, p_7, p_8, p_7, p_6, p_4, p_2\}$$

$$H_{10} = \{p_1, p_{10}, p_9, p_6, p_4, p_2\}$$

**Subroutine:** How do we take hull  $H_{k-1}$  and point  $p_k$ , and form hull  $H_k$ ?



$$H_{k-1} = \{p_1, \dots, \dots, \dots, \dots\}$$

$$H_k = H_{k-1}[\text{start} : \text{end}] + p_k$$



$$H_k = H_{k-1}[\text{start} : \text{end}] + p_k$$

