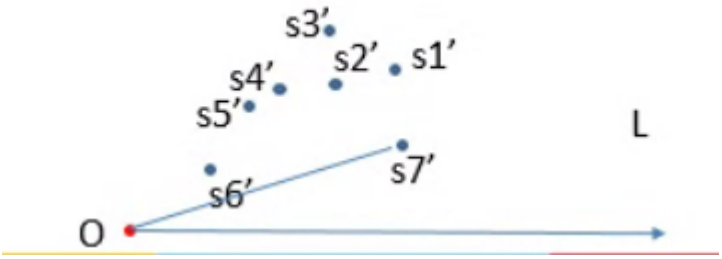
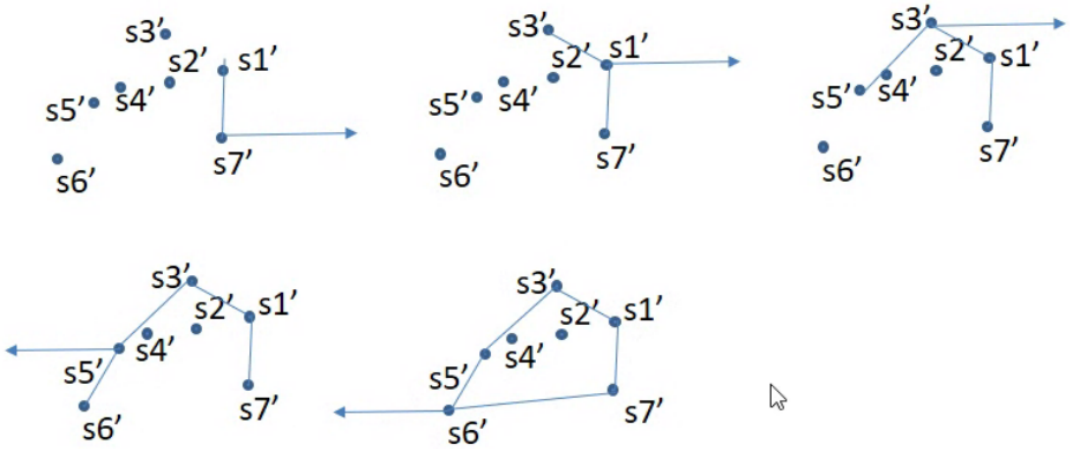
Gift Wrapping Algorithm / Jarvis March Algo

- Input: A point set S = $\{s_1, s_2, ...s_n\}$

1. Find a origin point O in the plan which is outside the convex-hull S. X_{origin} < min x_i and Y_{origin} < min y_i
2. Find $s_k \epsilon S$ such that $\theta_{0,k} \leq$ min $\theta_{0,i}$ where $\theta_{0,k}$ is the angle measured w.r.t a radial arm from the origin in an aribtrary direction (e.g anticlockwise). For equal minimum angle pick the point closest to the origin



3. Shift origin to s_k and repeat step 2 with consistent angle direction and origin intil first convex hull vertex is refound.



Pseudocode

Note: typo in slides in `if $\angle s_{i-2}s_{i-1}s$ > Max then` line.

- Input: A point set S
- Let s_1 be the leftmost point in S.
- Let s_2 be the points such that all other points lie to the right of line $s_1 s_2$
- $i \leftarrow 3$
- CH(S) $\leftarrow$ {($s_1 s_2$)}
- Repeat
    - Max $\leftarrow$ 0
    - for all s ϵ S do

        - if $\angle s_{i-2}s_{i-1}s$ > Max then
            - Max $\leftarrow \angle s_{i-2}s_{i-1}s_i$
            - $s_i \leftarrow$ s
            - i++
        - end_if
    - end_for
    - Append (s_{i-1}, s_i) to CH(S)
- until $s_i \neq s_1$

Time compexity

O(nh) Where h is number of points on convex hull.

This algo TC is dependant on output. This type of algos are called output sensitive algos.

Finding s_2 can be done in O(n) by using gift wrapping second step.