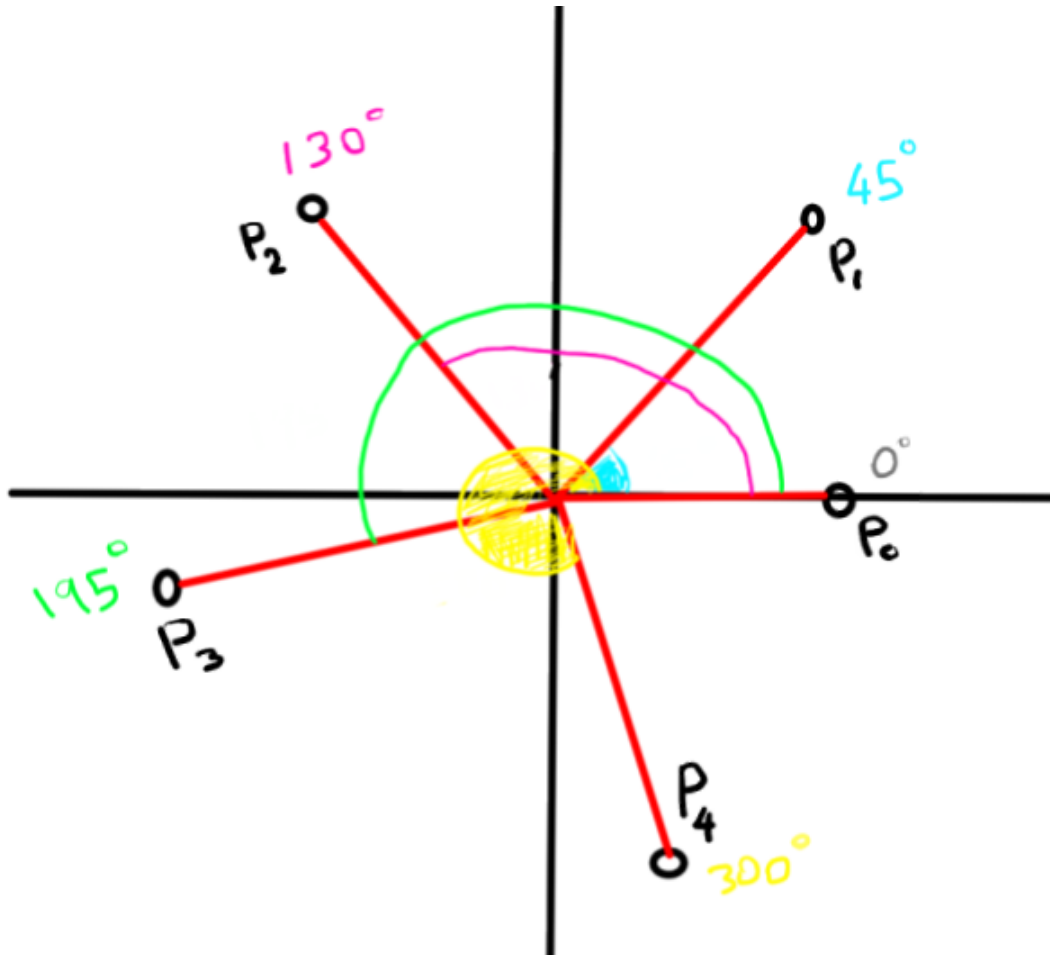


C. View Angle

If we have 5 points like this let's find the angles α_i :

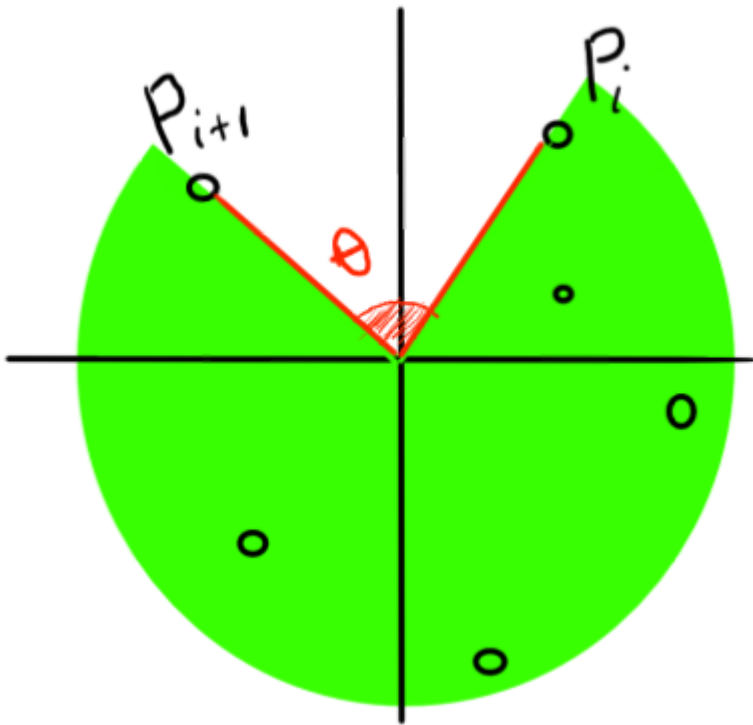
$P_i > \text{the origin} > \text{the positive x-axis}$ (in the counter clockwise direction).

Then sort the points according to their angles. $O(n \log n)$



Now if we have n point P_0, P_1, \dots, P_{n-1} and the angle $P_i > \text{the origin} > P_j$ is $\Theta_{i,j}$

then for any two consecutive points P_i, P_{i+1} there is a view angle to see all points and it will be the complement of $\Theta_{i,i+1}$ ($360 - \Theta_{i,i+1}$).



to get the minimum view angle we will iterate over all the points **$O(n)$**
 and find : $\min (360 - \Theta_{i,i+1})$, for $0 \leq i \leq n-2$

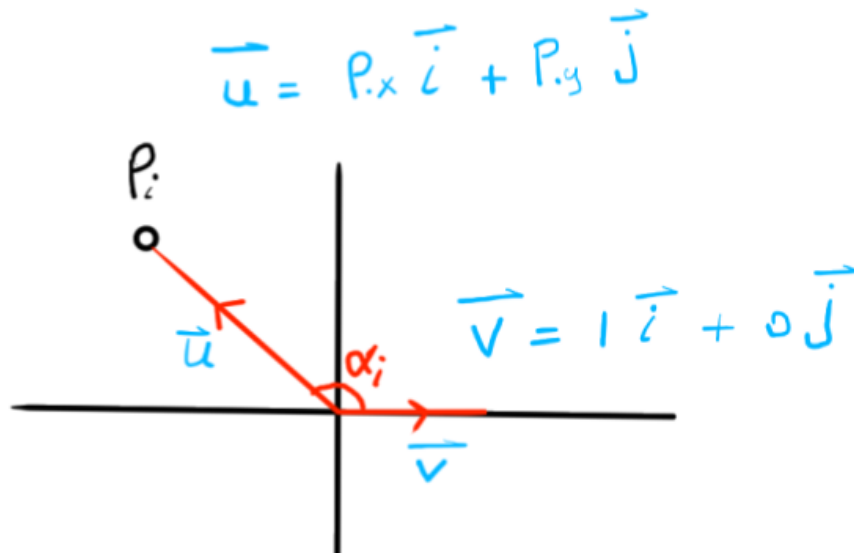
note : don't forget to find $(360 - \Theta_{0,n-1})$

To calculate $\Theta_{i,j}$: $\Theta_{i,j} = \text{abs}(\alpha_i - \alpha_j)$

To calculate α_i :

consider the vector $v = 1i + 0j$ (represents the positive x-axis)

and the vector $u = P_{i,x}i + P_{i,y}j$



now “from dot product” :

$$\alpha_i = \cos^{-1} ((P.x * 1 + P.y * 0) / (\|\vec{u}\| * \|\vec{v}\|)) = \cos^{-1} (P.x / \|\vec{u}\|)$$

but please note this case (if P is below the x-axis) :

we need $\alpha_i = 360 - \cos^{-1} (P.x / \|\vec{u}\|)$ because as mentioned above we care about the angle (in the counter clockwise direction)

My C++ solution :

<http://codeforces.com/contest/257/submission/40388893>

Best regards.

