Delaunay Triangulation

Randomized Incremental Construction

- In-Circle Test

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In-Circle Test

- Recall that when all sites are in general position, we have that

  a triangle $\Delta(a, b, c)$ belongs to DT(S) iff

  its circumcircle is empty inside

- In the design of the RIC algorithm

  a basic issue is that

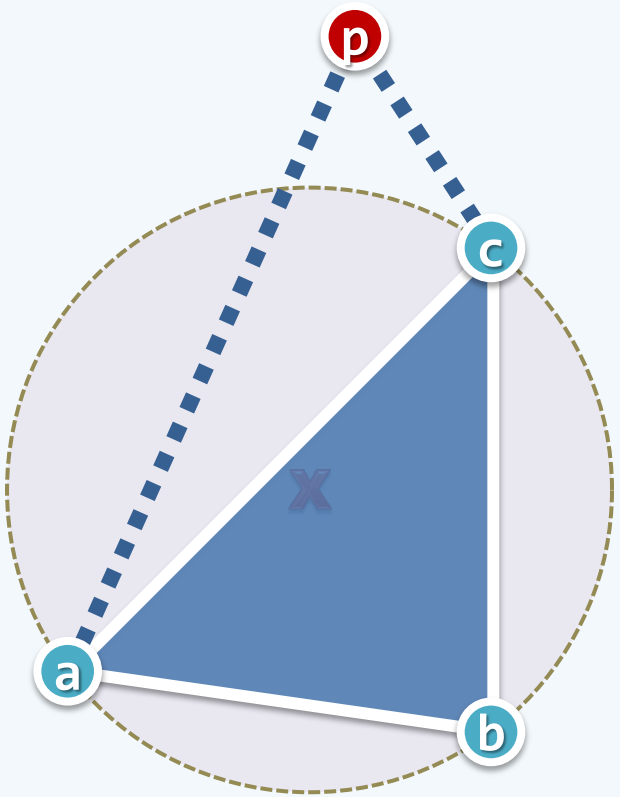
  before updating the triangulation

  when a new site p is added,

  1) how to test whether p lies interior

     to the circumcircle of $\Delta(a, b, c)$? and

  2) how fast could we do it?



Determinant

❖ Let InCircle(a, b, c, p) =

$$\begin{vmatrix} a_x & a_y & a_x^2 + a_y^2 & 1 \\ b_x & b_y & b_x^2 + b_y^2 & 1 \\ c_x & c_y & c_x^2 + c_y^2 & 1 \\ p_x & p_y & p_x^2 + p_y^2 & 1 \end{vmatrix}$$

❖ p lies in the circumcircle of Δ(a, b, c) iff

InCircle(a, b, c, p) > 0

❖ Note that

such an in-circle test

just needs $O(1)$ time