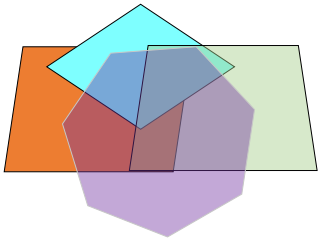
A. Polygon-Toolkit for Analyzer

Constraint: Time Limit: 3 seconds, Memory: 256MB

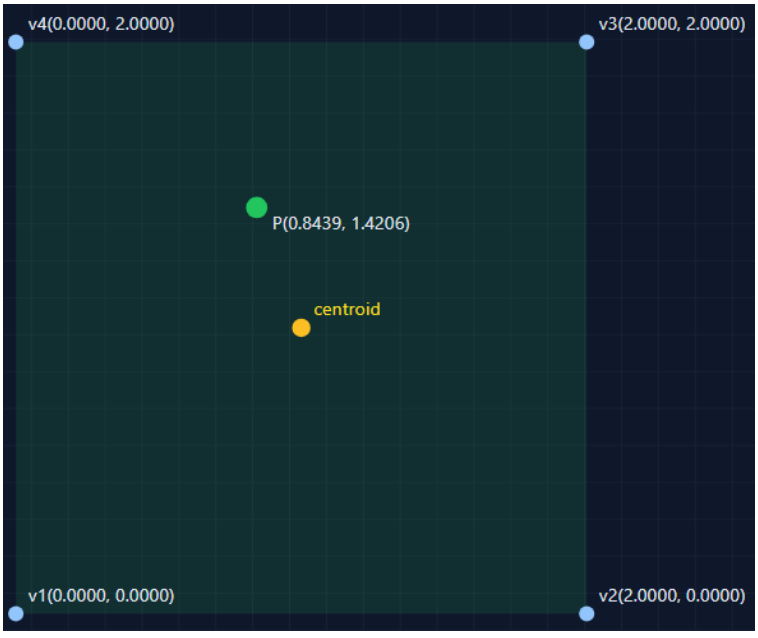


Problem description

Your task is to build a Polygon toolkit, which allows the user to enter a simple (non-self-intersecting) polygon with N (is an integer ≥ 3 ; ≤ 20) vertices is provided in order (either clockwise or counter-clockwise), each vertice can be described as $V_i = (V_i^x, V_i^y)$, followed by a point $P = (P^x, P^y)$.

- AREA = polygon area (non-negative), rounded to 4 decimal places. use the *shoelace formula* on the ordered vertices; output abs(signed_area).
- PERIMETER = polygon perimeter, rounded to 4 decimal places
- CONVEX = whether the polygon is convex (YES/NO)
- POINT = relative position of P w.r.t. the polygon (INSIDE/ON/OUTSIDE)
- CENTROID = polygon centroid (C^x, C^y), rounded to 4 decimal places
    - If the polygon is degenerate (area = 0), print CENTROID=NaN

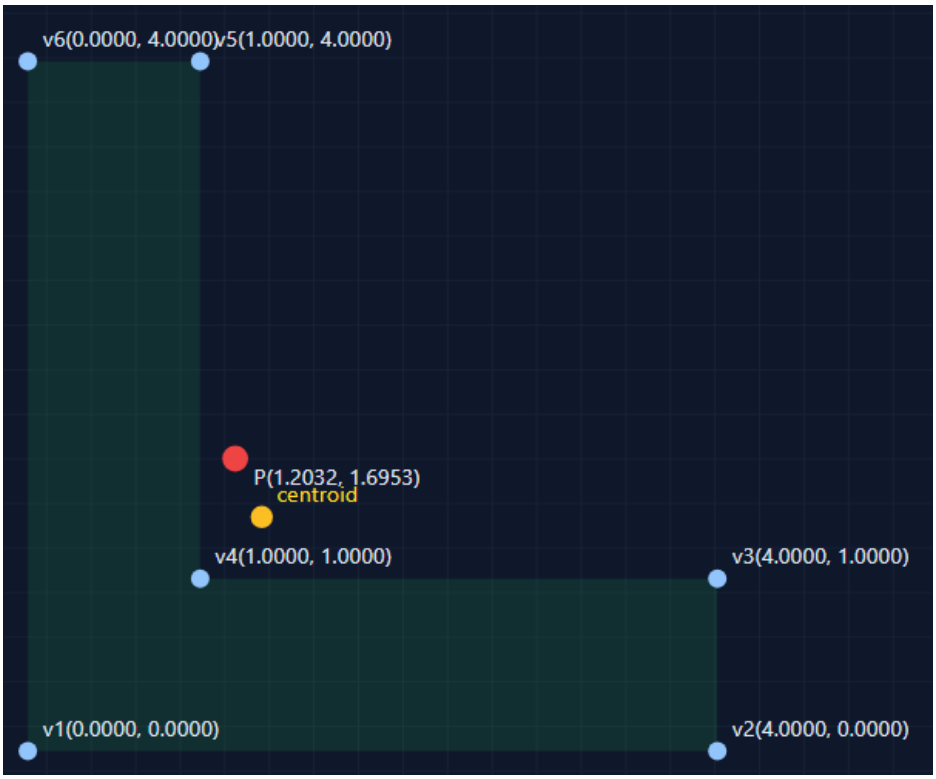
Consider Example 1, where 4 input vertices are formed a square as following:



INPUT	OUTPUT
4 0.0000 0.0000 2.0000 0.0000 2.0000 2.0000 0.0000 2.0000 0.8439 1.4206	AREA=4.0000 PERIMETER=8.0000 CONVEX=YES POINT=ON CENTROID=1.0000 1.0000

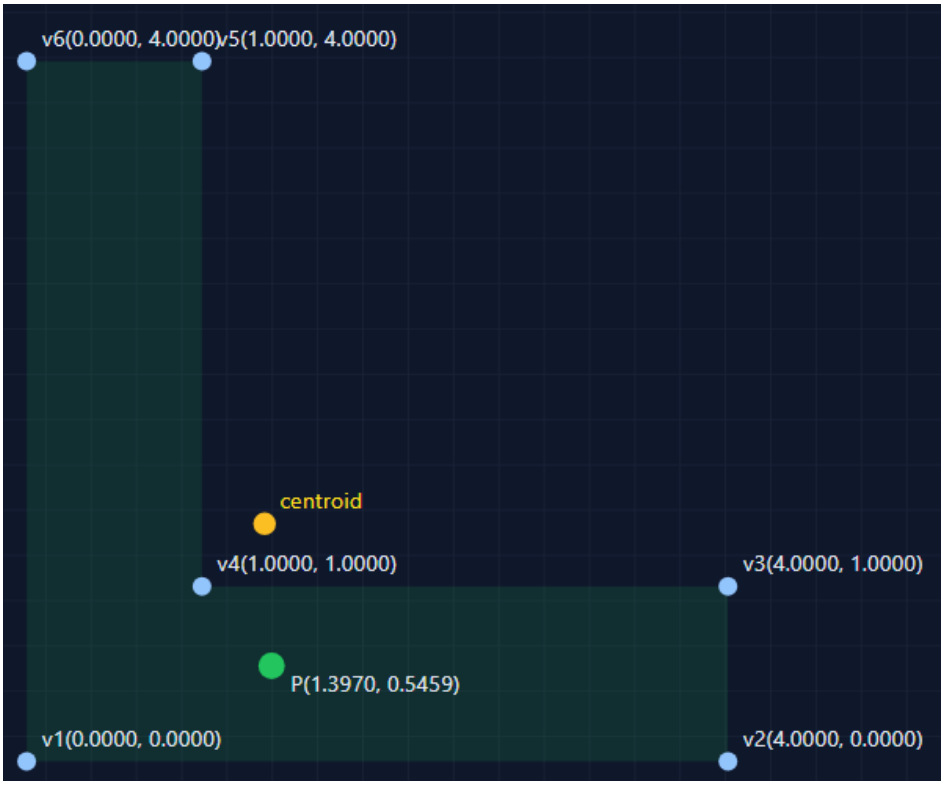
Example 2

INPUT	OUTPUT
6 0.0000 0.0000 4.0000 0.0000 4.0000 1.0000 1.0000 1.0000 1.0000 4.0000 0.0000 4.0000 1.2032 1.6953	AREA=7.0000 PERIMETER=16.0000 CONVEX=NO POINT=OUTSIDE CENTROID=1.3571 1.3571



Example 3

INPUT	OUTPUT
6 0.0000 0.0000 4.0000 0.0000 4.0000 1.0000 1.0000 1.0000 1.0000 4.0000 0.0000 4.0000 1.3970 0.5459	AREA=7.0000 PERIMETER=16.0000 CONVEX=NO POINT=INSIDE CENTROID=1.3571 1.3571



Example 4

INPUT	OUTPUT
3 0.0000 0.0000 1.0000 0.0000 2.0000 0.0000 1.0000 0.0000	AREA=0.0000 PERIMETER=4.0000 CONVEX=YES POINT=ON CENTROID=NaN