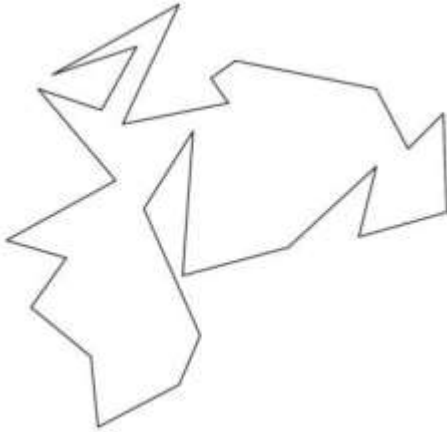**Homework Set - 02 (Total Marks = 20)**

Q1. Consider the simple polygon shown below:

Show a partition with minimum number of *y*-monotone polygons. Justify the minimality of partition.
[3 + 2]

2. Given *n* points in general positions in the 2D-plane, sketch an $O(n \log n)$-time algorithm for determining the Tukey depth of a query point.   [5]

3. You are given a simple polygon *P* with *n* sides and two points *s* and *t* in *P*, and let *T* denote a triangulation of *P*. Show that the Euclidean shortest path (ESP) between *s* and *t* is unique. Also show that the minimal set of triangles containing the ESP forms a path in the dual tree of *T*. [2 + 3]

4.(a) Let *L* be an arbitrary line segment interior to a convex polygon *P* with *n* vertices. Does there exist a triangulation such that the number of intersections of *L* with all diagonals become $O(\log n)$? If so, provide a method for constructing such a triangulation. [3]

(b) Are there any polygons such that for *any triangulation*, such a line *L* will have $\Omega(n)$ intersections with diagonals? If so, show an example.   [2]

Submit solutions via Moodle. **Due:** January 28, 2022, 23:55; Credit: 10%