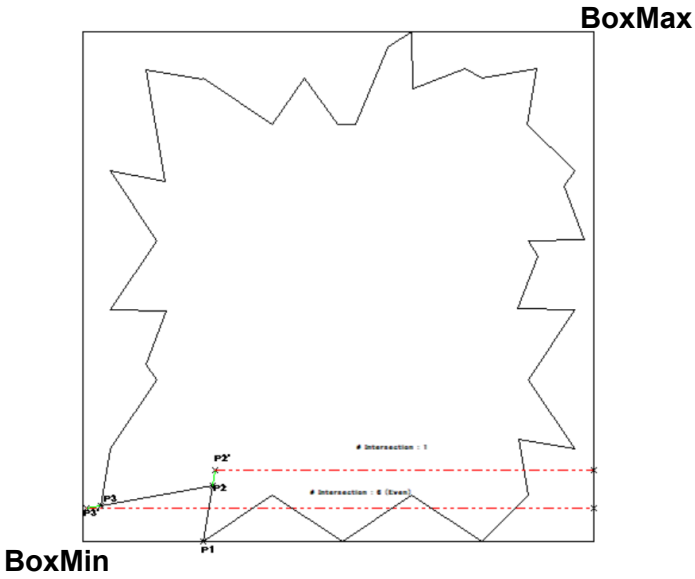
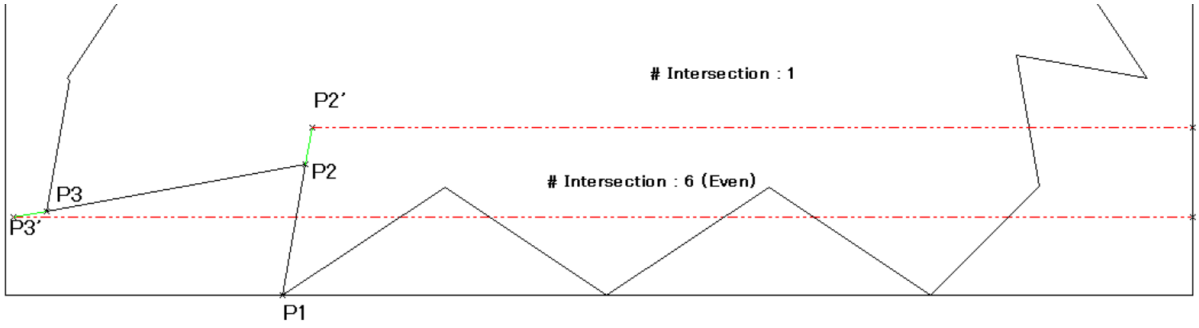


Task1 :

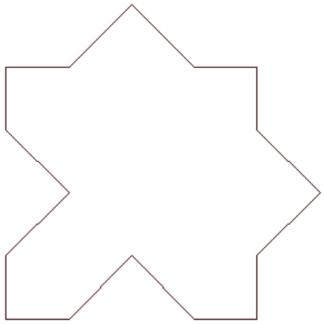
To find the convex hull for the given polygon.

Logic :

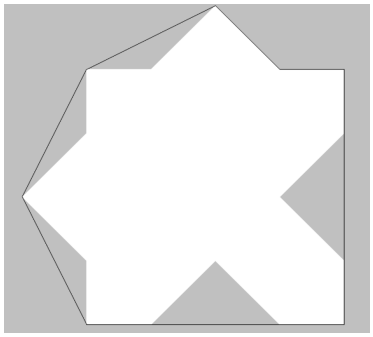
1. Sort all the vertices clockwise.
2. Find the lowest point in our case lets take (P1).
3. Project next vertex P2 to dx distance along the same line P1-P2.
4. Let P2’ be the projected point.
5. P2’ is inside the polygon, hence P2 is not part of the convex hull.
6. Project next vertex P3 to dx distance. Let P3’ be the projected point.
7. P3’ is outside the polygon, hence P3 is part of the convex hull.
8. To find inside or outside the polygon, use Intersection logic.
9. Draw a horizontal line from the projected point till BoxMax.
10. If there are odd no of intersections then the point is inside otherwise outside.
11. In the above diagram, P2’ intersect with only one edge hence P2’ is inside the polygon, Whereas P3’ intersects with 6 edges hence it is outside the polygon.



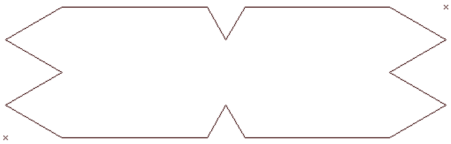
Test cases for above algorithm:



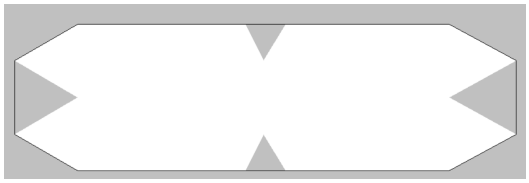
Polygon with 16 vertices



Convex hull with 7 vertices



Polygon with 16 vertices



Convex hull with 8 vertices

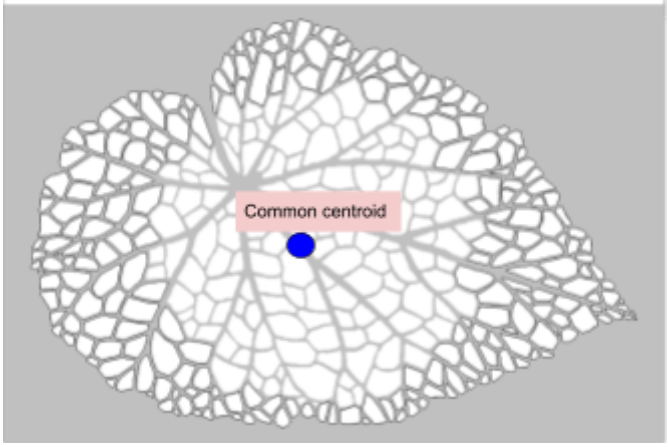
Task 2 :

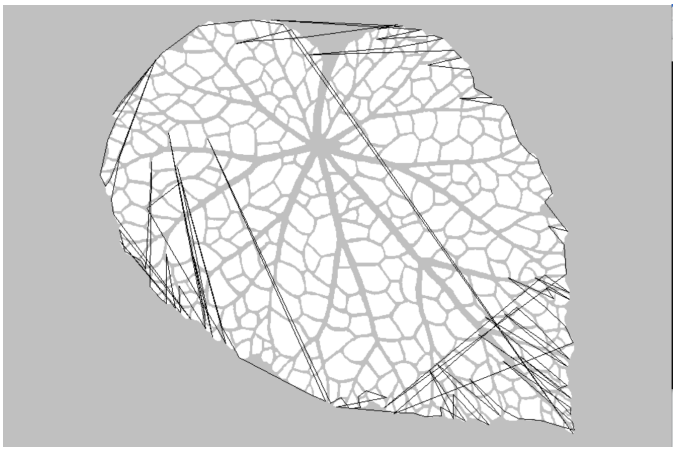
Find an overall convex hull for all 397 polygons.

Logic :

1. Find centroid for all 397 polygons.
2. Find a common centroid for 397 centroid points.
3. Find the centroid which is far away from the common centroid and calculate the distance.
4. Use 50% of that calculated distance as the limit to find the outer polygons.

5. Find all outer polygons whose centroid is located greater than the above calculated limit. In the given image, highlighted polygons are further away than limit from the common centroid.
6. All the outer polygons would contribute to the overall convex hull for 397 polygons.
7. From all outer polygons find the vertex which is farthest from the common centroid.
8. If there are 170 outer polygons the there will be 170 points which are far away from the common centroid.
9. Find the convex hull for all the 170 points which would give the approximate convex hull around all 397 polygons.
10. This logic would give us approximated results only.
11. This algorithm has predicted 145 points as the overall convex hull around the 397 polygons.





Importance of this approach :

- Importance of this approach is to find out the approximate convex hull and then refine it to get the exact hull.
- The above found 145 points would contain all the outer convex hull points of the 397 polygons.
- These 145 points can be given to graham's algorithm which would return an exact convex hull. This approach would reduce the 15 thousand points to 145 points to find out the convex hull around the 397 polygons.