1. **30 points.** Define each of the following terms (using at most 2 sentences each):

   (a) convex hull of a set of points,

   (b) Voronoi diagram,

   (c) point location data structure.

2. **30 points.**

   (a) Draw, as best you can, the Voronoi diagram for the set of points
   \{(2, 1), (0, 0), (2, 5), (3, 2), (4, 3), (5, 3), (5, 1)\}.

   (b) Sketch an efficient algorithm to construct a Voronoi diagram for a set \(S\) of \(n\) points in the plane.

   **NOTE:** For the remainder of this exam you may assume that you have a subroutine for any problem we discussed in class, provided you can correctly characterize its performance bounds.

3. **30 points.** Suppose you are a set \(S\) of \(n\) points in the plane. Define the **diameter** of \(S\) to be the largest distance between two points in the set. Briefly describe an \(O(n \log n)\) time method for determining the diameter of \(S\).

4. **30 points.** Suppose you are given two sets, \(A\) and \(B\), of points in the plane, where \(A\) and \(B\) both contain \(n\) points each. Describe an efficient method for finding, for each point in \(A\), its nearest neighbor in \(B\). What is the running time of your method?

5. **30 points.** Suppose you are given a set \(S\) of \(n\) points in \(\mathbb{R}^3\). Describe an efficient data structure that can determine, for any query point \(p \in \mathbb{R}^3\), in \(O(\log n)\) time whether \(p\) is inside the convex hull of \(S\) or not. What is the preprocessing time and space for your data structure?