1. **30 points.** Define each of the following terms (using at most 2 sentences each):
   
   (a) polygon triangulation,
   
   (b) convex hull,
   
   (c) simple polygon.

2. **30 points.** Describe an efficient plane-sweeping method for finding the convex hull of \( n \) points in the plane. Be sure to indicate the invariant, events, and data structures needed for this plane sweep, as well as the methods for processing each event.

3. **30 points.** Describe the main components of a segment tree defined on a set \( I \) of \( n \) intervals from \( \mathbb{R} \), the set of real numbers. Describe how one can use this segment tree to report all the intervals containing a query point \( x \) in \( O(\log n + k) \) time, where \( k \) is the number of intervals in \( I \) that contain \( x \).

   **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.

4. **30 points.** Describe an efficient algorithm for determining the area of a simple polygon \( P \) containing \( n \) vertices. What is the running time of your method?

5. **30 points.** Suppose you are given a set \( S \) of \( n \) axis-aligned rectangles in the plane. Describe an efficient method for finding a point \( p \) in the plane that is contained in the most number of rectangles from \( S \). What is the running time of your method?