Computational Geometry Algorithms

Computational Geometry Algorithms

1. **Definition**
    - Algorithms that solve geometric problems: points, lines, polygons, and their relationships in 2D or higher-dimensional space.
2. **Convex Hull**
    - Finds the smallest convex polygon that encloses a set of points; algorithms include Graham Scan and the Jarvis March, typically O(n log n).
3. **Line Segment Intersection**
    - Efficiently determines which pairs of line segments intersect, using sweep-line algorithms rather than brute-force pairwise comparison.
4. **Closest Pair of Points**
    - Uses a divide-and-conquer approach to find the two closest points in a set in O(n log n) time, much faster than the naive O(n^2) approach.
5. **Applications**
    - Geographic Information Systems (GIS), computer graphics/rendering, robotics path planning, and computer-aided design (CAD).
6. **Why It's Challenging**
    - Geometric algorithms must carefully handle edge cases like collinear points and numerical precision issues that don't arise in purely combinatorial algorithms.