Computational Geometry
Chapter-0
(Orientation)

Bulbul Ahammad
Asst. Professor, Dept. of CSE, JU
Email: bulbul@juniv.edu

Contents

Chapter No.	Chapter Title	Description
CGCH-01	Basic Geometry	1. triangle and its category 2. Congruence of triangles 3. Similarity of triangles 4. Circles and their related theorems 5. Areas related to circles (areas of segment and sector of a circle) 6. Law of sine of triangle 7. Law of cosine of triangle 8. Circumcircle 9. Incircle 10. Application of binary search in geometry 11. Application of ternary search/differentiation in geometry

Contents

Chapter No.	Chapter Title	Description
CGCH-02	Points, Vectors, Lines and Line Segments	1. Point and line representation 2. Counterclockwise Function (CCW) 3. Vector representation 4. Dot product 5. Cross product 6. Lattice points 7. Closest pair of points (naive approach, divide & conquer) 8. Line segments intersection checking 9. Intersection point of lines 10. Finding intersection of two segments 11. Length of union of line segments 12. Minimum lines to cover all points 13. Area of union of triangles, vertical decomposition method

Contents

Contents

Chapter No.	Chapter Title	Description
CGCH-02	Polygon	1. Polygon and its classifications 2. Area of simple polygon with ordered vertices 3. Point in polygon checking 4. Art gallery theorem 5. Tangents between two convex polygons 6. Check if point belongs to convex polygon in O(logn) 7. Minkowski sum of convex polygon 8. Pick's theorem 9. Number of lattice points inside lattice polygon 10. Lattice points of non-lattice polygon 11. Finding the incircle in a convex polygon using ternary search in O(Nlog2C) 12. Catalan number 13. Non-intersecting chords in circle 14. Ways of polygon triangulation

Contents

Chapter No.	Chapter Title	Description
CGCH-02	Polygon	1. Minimum score polygon triangulation using matrix chain multiplication 2. Monotone chain, Monotone polygon, monotone mountain 3. Triangulating monotone polygon 4. Trapezoidalization of polygon 5. Centers of gravity of polygon and polyhedra

Contents

Chapter No.	Chapter Title	Description
CGCH-04	Convex Hull	1. Convex hull construction 1.1. Jarvis Algorithm or Wrapping 1.2. Monotone chain algorithm 1.3. Graham scan 1.4. Quick hull algorithm 1.5. Divide and conquer 2. Convex hull trick and Li Chao tree 3. Dynamic convex hull-adding points to an existing convex hull 4. Deleting points from convex hull

Contents

Chapter No.	Chapter Title	Description
CGCH-05	Sweep line	1. Search for a pair of intersecting segments 2. Point location in O(logn) 3. Closest pair of points

Contents

Chapter No.	Chapter Title	Description
CGCH-05	Geometric data structure	1. K-d trees 2. Orthogonal range searching 3. Priority search trees

Contents

Chapter No.	Chapter Title	Description
CGCH-06	Proximity	1. Delaunay triangulation 2. Voronoi diagram 3. Half plane intersection-S&I algorithm in O(nlon) 4. Geometric inversion transform