

Computational Geometry

R. Inkulu at cse.iitg

Overview [dB]: 1-2, 10-13

Windowing queries

Bentley-Shamos locus approach [PS]: 36-39

Quadtree [dB]: 309-315; [P]: 13-19

BBST for points on a line [dB]: 96-99

Kd-tree [dB]: 99-105

Range tree [dB]: 105-109, 111-115

Priority search tree [dB]: 226-230

BSP tree [dB]: 261-267, 271-278

Partition tree [dB]: 336-343

Cutting tree [dB]: 346-351

Stabbing queries

Interval tree [dB]: 220-226; [CLRS]: 348-353

Segment tree [dB]: 231-237

Intersections

Line segments [dB]: 20-29

Overlay of subdivisions [dB]: 33-40

Convex polygons [PS]: 271-277

Convex polytopes [[DobKirk '90](#)]: 2-5

Arrangements

Algo for faces in arrangements [dB]: 179-185

Applications of arrangements [[note](#)]

Point-line incidences [P]: 129-130, 135-140; wiki: [[1](#)], [[2](#)], [[3](#)]

Planar point location

Using quadtree [dB]: 309-311

DCEL [dB]: 29-33

Simple/Convex polygon inclusion [PS]: 41-43

Slab method: plane sweep [PS]: 45-48

Chain method [PS]: 48-56

Kirkpatrick's triangulation refinement [PS]: 56-60

Randomized incremental [dB]: 128-137

Convex hulls

- Combinatorics [PS]: 96-99; [dB]: 243-246
- Construction in plane [PS]: 104-117; [TChan '96](#): 2-3
- An appl: point set diameter [PS]: 176-182
- Dynamic hull tree [PS]: 124-131
- Hull of a simple polygon [PS]: 166-171
- Construction in \mathbb{R}^3 [PS]: 96-99, 141-145; [dB]: 246-252
- Combinatorics of convexity [P]: 217-218

Planar triangulations

- Preliminaries [dB]: 46-47, 193-194
- Simple polygons [dB]: 49-55; [PS]: 239-241
- Point sets [PS]: 234-237; [dB]: 194-195, 198-208
- Proximity graphs [dB]: 216-217; [Touss '80](#) --- EP

Voronoi diagrams

- Properties [PS]: 204-211; [dB]: 148-151
- Algorithmic applications [PS]: 220-222, 227, 258-259
- Construction algorithms [PS]: 211-220; [dB]: 151-159
- Farthest-point VD [dB]: 164-167; [PS]: 257; [wiki](#)

Duality

- Common transforms [dB]: 177-179; [PS]: 243-244
- Few applications [dB]: 173-177, 179, 253-255; [note](#)

Closest pair of points

- Using divide-and-conquer [PS]:195-199 --- prereq
- Using randomized incremental construction [KT]: 741-750
- Using Voronoi diagram

Algo for LP in plane [dB]: 66-82; [PS]: 292-297

Smallest enclosing disk [dB]: 86-89; [P]: 210-213

Visibility

- Art gallery theorem [dB]: 46-48
- Visibility graph of polygonal obstacles [dB]: 326-330

Path planning

- Shortest path tree in simple polygon [\[LeePrep '84\]](#)
- Translating convex polygon [dB]: 284-299, 124-128

Power of grids

Minimum radius k-enclosing disk in plane [P]: 5-10

Covering points in plane by min number of unit disks [P]: 151-155

ANN queries [P]: 158-160

Coreset for directional width [P]: 291-294

WSPD and its applications [P]: 29-39

Worst-case lower bounds

For several geometric problems [PS]: 99-100, 172, 176-177, 192-194, 212, 260, 280, 289; [\[note\]](#)

Few 3SUM-hard problems [\[Overmars '95\]](#) --- AR

* [PS]: Computational Geometry: An Introduction by Franco P. Preparata and Ian Shamos, First Edition.

* [dB]: Computational Geometry: Algorithms and Applications by Mark de Berg et al., Third Edition.

* [P]: Geometric Approximation Algorithms by Sariel Har-Peled, First Edition.

* AR stands for additional reading (no lecture delivered).
