CS133
Computational Geometry

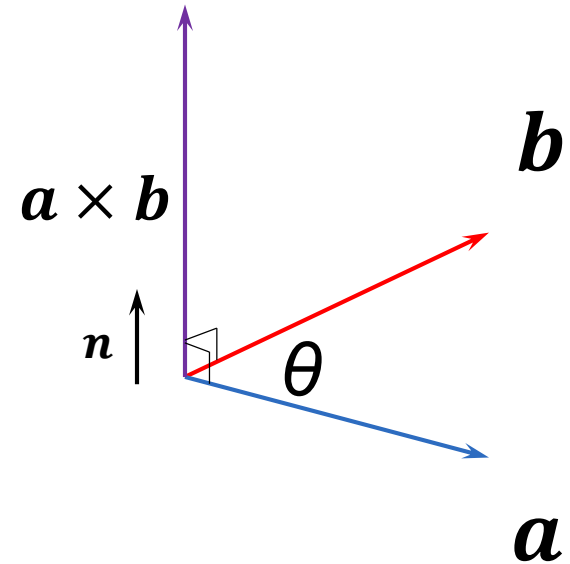Review

Topics

> Linear Algebra

> Primitive operations

> Convex hull

> Intersection problems

> Search problems

> Closest/Farthest pair

> Simplification

> Triangulation

> Delaunay Triangulation/Voronoi Diagram
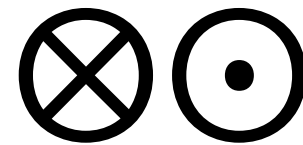
Cross Product

$$a \times b = \|a\|\|b\| \sin(\theta)\, \boldsymbol{n}$$

$$a \times b = a_1 b_2 - a_2 b_1$$

The result of a cross product is a vector

$$a \times b = -b \times a$$

CG Primitives

- CCW order
- Collinearity test
- Line-point relationship
- Line-line relationship
- Line-line intersection
- Triangle area
- Circumcircle test

Convex Hull

> Convex polygon properties

> Convex hull problem

> Graham scan

> Andrew's monotone chain algorithm

> Jarvi's March/Gift wrapping

> Divide-and-conquer algorithm

> Incremental hull

> Quick hull

Intersection Problems

> Line-segment intersection

> Rectangle intersection

> Polygon intersection

> Convex polygon intersection

> Plane-sweep algorithms

Search Problem

- Range search
- K-d tree index

Closest/Farthest Pair

> Closest pair

> > Divide-and-conquer algorithm

> > Proof of linear-time merge

> Farthest pair

> > Convex hull properties

> > Rotating calipers method

Simplification/Triangulation

> Douglas-Peucker line simplification algorithm

> Triangulation properties

> Triangulation of convex polygons

> Triangulation of simple polygons

Voronoi Diagram
Delaunay Triangulation

> Properties of Voronoi diagram

> Properties of Delaunay triangulation

> Duality of the two constructs

> Plane sweep algorithm

> Divide-and-conquer algorithm

> Incremental algorithm

> DCEL data structure