Overview

- Today
  - HW3
  - Student Presentations
  - Stroke Geometry
- Thursday – NO CLASS
  - Student group meetings
  - Plan for early prototype

Prototype

- Aim to have some working in two weeks
- Pen based application that does something from your main scenario
- Use Thursday class period for group meetings to plan this out
- Each group submit a plan by email to instructor by Friday night

Homework 3

- Tic-tac-toe

  Challenges
  - Simple Reco
  - Geometry
  - Harder than HW1 or HW2

Stroke Representation

- Sequence of packets
  - Coordinates in HIMETRIC Units
  - Sampled ~150 points / sec
  - Fourth quadrant coordinates

Interpolation

What is Points[6.4]?
Interpolation

Points[6.4] = 0.6*Points[6] + 0.4*Points[7]

Basic geometry

- Line segment
  - \((p_1, p_2)\)
- Basic Test
  - Left of
    - \(\text{CCW}(p_1, p_2, p_3)\)

Counter Clockwise Test

- \(\text{CCW}(p_1, p_2, p_3)\)

```csharp
public static bool CcwTest(Point p1, Point p2, Point p3)
{
    int q1 = (p1.Y - p2.Y)*(p3.X - p1.X);
    int q2 = (p2.X - p1.X)*(p3.Y - p1.Y);
    return q1 + q2 < 0;
}
```

CCW Test Derivation

- Translate \(p_1\) to the origin
- Rotate \(p_2\) to x axis
- Check the y-coordinate of \(p_3\)

Line intersection

- Find intersection of \((p_1, p_2)\) and \((p_3, p_4)\)
  - \(Q = \alpha p_1 + (1-\alpha)p_2\)
  - \(Q = \beta p_3 + (1-\beta)p_4\)
- Solve for \(\alpha, \beta\)
- Two equations, two unknowns
- Derived points
  - In general, try to avoid computing derived points in geometric algorithms

Distance

- \(\text{Dist}(p_1, p_2)\)
  - \(\sqrt{(p_2.x - p_1.x)^2 + (p_2.y - p_1.y)^2}\)
- Distance comparisons can be done without sqrt
  - \(\text{Dist}(p, s) = \min (\text{Dist}(p, q) \text{ for } q \in s)\)
Center of Mass

- Center of Mass, Cm:
  - \( Cm = \sum_i p_i / n \)
  - Easy to compute “approximate” center

- Diameter: maximum distance between pair of points
- Radius: distance to center of smallest enclosing circle

Convex hull

- Smallest enclosing convex figure
- Rubber band “algorithm”

Convex Hull Algorithms

- Gift wrapping

Divide and Conquer