CS529
Fundamentals of Game Development

Lecture 4

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Overview

- Static Collision
  - Point/Circle
  - Circle/Circle
  - Point/Rectangle
  - Rectangle/Rectangle

Static Collision – Point/Circle

- Can be used for small objects, or objects' corners
- Compare the "Point to Center" distance to the radius
- Broken down to 3 cases:
  - |CP| < R: The point is inside the circle -> Collision
  - |CP| > R: The point is outside the circle -> No collision
  - |CP| = R: The point lies on the perimeter of the circle. It can be considered as either colliding or non-colliding, but be **consistent.**

Static Collision – Circle/Circle (1/2)

- Multiple "mathematical" cases
- In games, it's enough to compare the centers' distance to the sum of the radii
  - Point centerA, centerB
    float radiusA, radiusB

    RadiusSum = radiusA + radiusB
    CentersDistance = Length(centerA, centerB)

    if(CentersDistance <= RadiusSum)
      Collision
    else
      No Collision

Static Collision – Circle/Circle (2/2)

- "Length" can be avoided
  - Square root operations are expensive
- Solution: Square both sides
  - Point centerA, centerB
    float radiusA, radiusB

    RadiusSumSq = (radiusA + radiusB)²
    CentersDistanceSq = LengthSquared(centerA, centerB)

    if(CentersDistanceSq <= RadiusSumSq)
      Collision
    else
      No Collision

Static Collision – Point/Rectangle

- Again, enough for small objects
- Rectangle is defined as: Top, Bottom, Left & Right
- Algorithm:
  - Point P;
    float left, right, top, bottom;

    if(P.X < left) then no collision
    if(P.X > right) then no collision
    if(P.Y < bottom) then no collision
    if(P.Y > top) then no collision

    Collision!

Static Collision – Rectangle/Rectangle (1/2)

- Used in bounding rectangles
- Algorithm:
  - float leftA, leftB
    float rightA, rightB
    float topA, topB
    float bottomA, bottomB

    if(leftA > rightB) then no collision
    if(leftB > rightA) then no collision
    if(topA < bottomB) then no collision
    if(topB < bottomA) then no collision

    Collision!

Static Collision – Rectangle/Rectangle (2/2)