CSI 3202 Micro-Computer Graphics Primitives

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Outline

- Classes
- Polygon Basics
- Approximating a sphere
- Triangulation
  - Demo
- Polygon Offset
- Stitching/z-Fighting
  - Demo
- Questions
- Review Questions

Classes of Primitives

- Geometric
  - Points, lines, polygons, curves, surfaces
- Raster/Image
  - Arrays of pixels, textures etc…

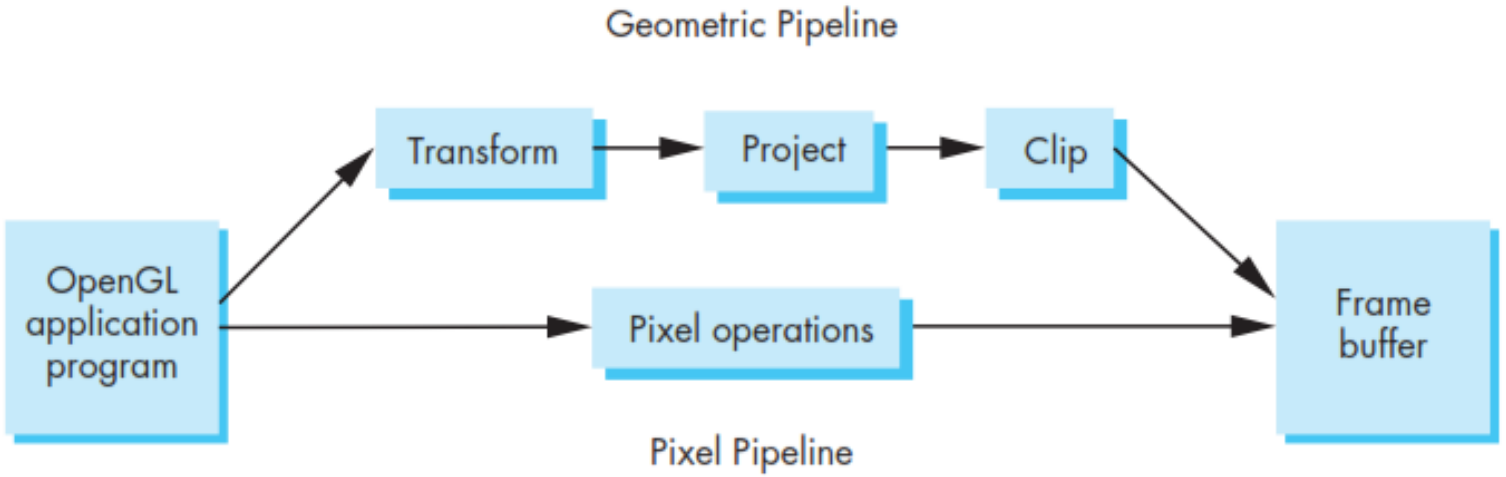


FIGURE 2.6 Simplified OpenGL pipeline.

Geometric Primitives

- Point (GL_POINTS)
  - Each vertex is the size or at least one pixel
- Line Segments (GL_LINES)
  - Success pairs of vertices interpreted as line segments
- Polylines (GL_LINE_STRIP, GL_LINE_LOOP)

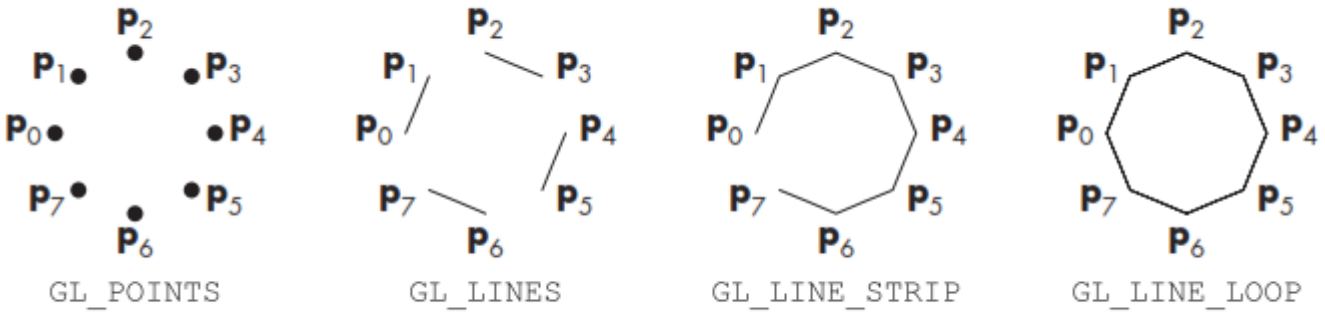


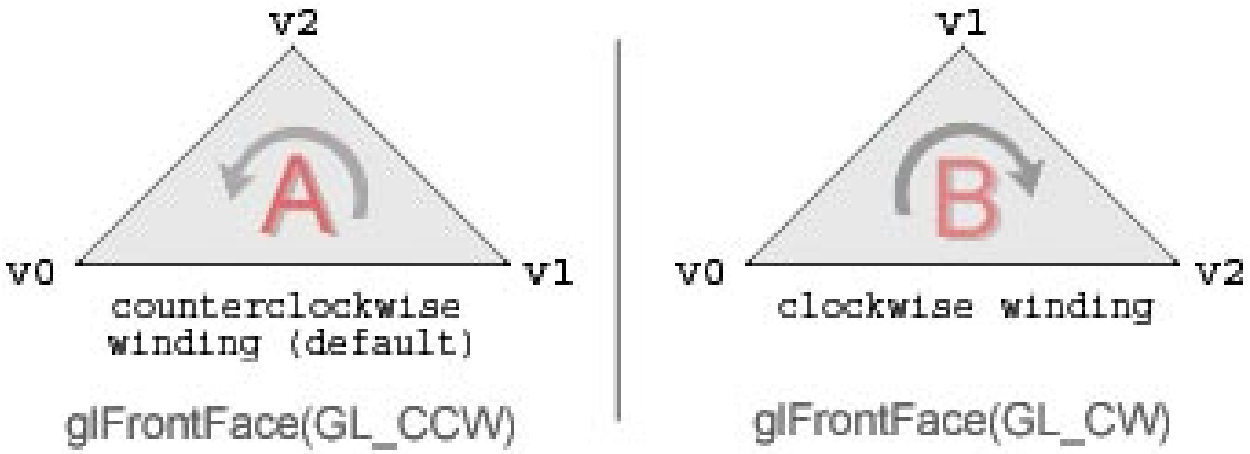
FIGURE 2.7 Point and line-segment types.

Polygons

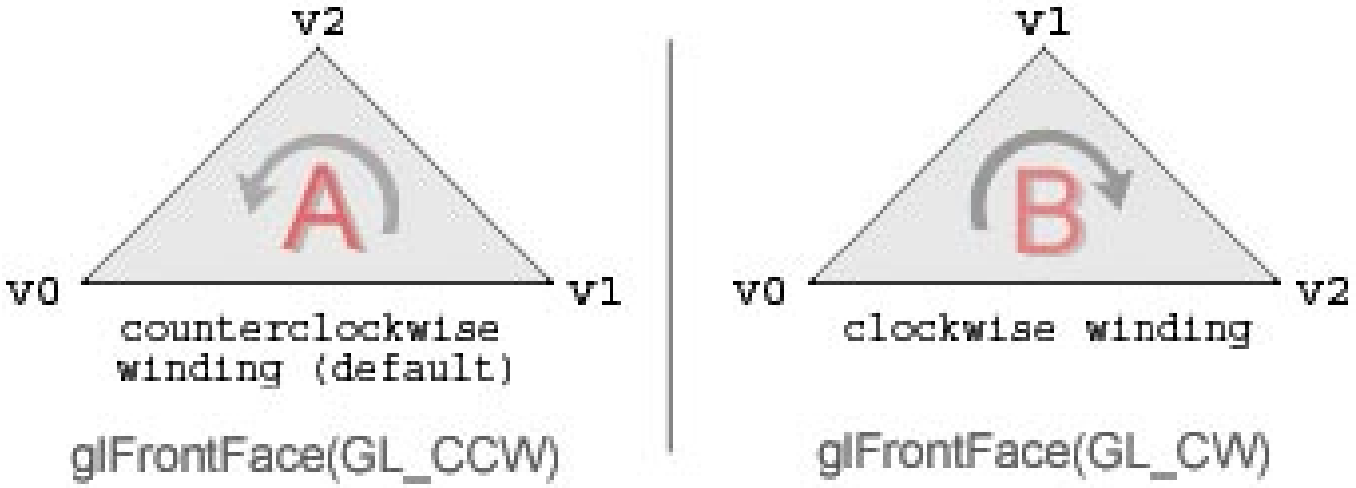
- Polygon – any object that has closed borders
- Can render
  - Edges only, interior with solid color, or with pattern, and with or without the edges
- 3 properties to ensure that it is display correctly
  - simple, convex, and flat
- Convex objects
  - triangles, tetrahedra, rectangles, circles, spheres, and parallelepipeds

The face of the polygon?

- Polygon has two sides
  - GL_BACK and GL_FRONT
  - Vertices specified in CW and CCW directions
  - Default is CCW, command to specify with way to draw, glFrontFace(GL_CCW);



The face of the polygon?



- After a call to glFrontFace(GL_CW); polygons drawn with vertices in CW that will be the front
- You can specify lighting to both sides of the polygon by GL_FRONT_AND_BACK

Triangles

- Displayed as
  - Points
  - Edges
  - Interior filled

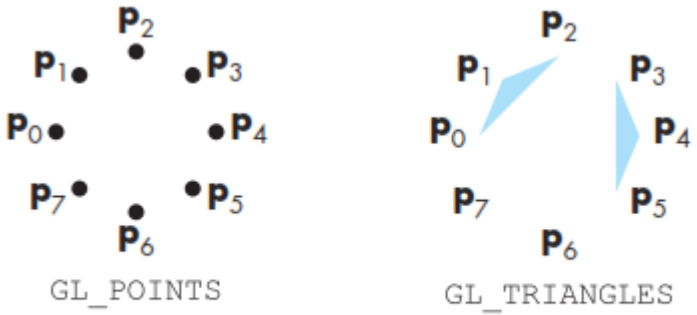


FIGURE 2.13 Triangle types.

- glPolygonMode is used to instruct the renderer to generate only edges, or points, or fill (default)

Triangles

- **Strips and Fans**
  (GL_TRIANGLE_STRIP, **GL_TRIANGLE_FAN**)

FIGURE 2.14 Triangle strip and triangle fan.

Triangulation

- Triangles are easiest to render….
- A usual strategy is to start with a list of vertices and generate a set of triangles consistent with the polygon defined by the list, a process known as **triangulation**

Sphere Approximation with Polygons

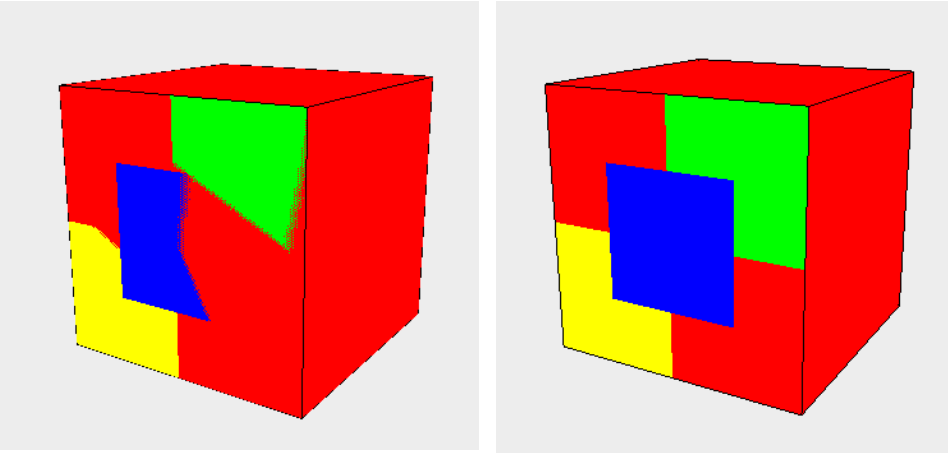
- Demo….

What is Polygon Offset?

- Polygon offset is a technique used and implemented to solve the following problems
  - Z-fighting
  - stitching

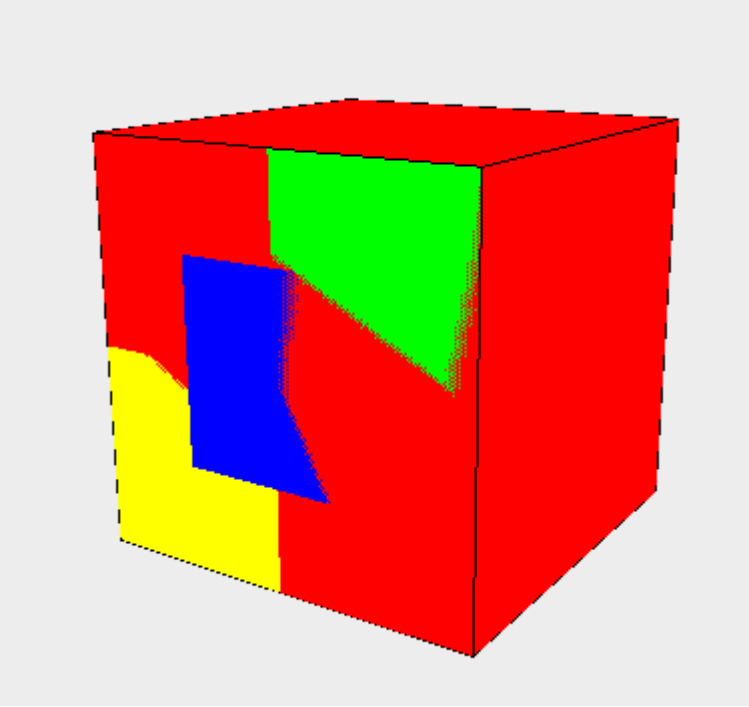
Stitching?

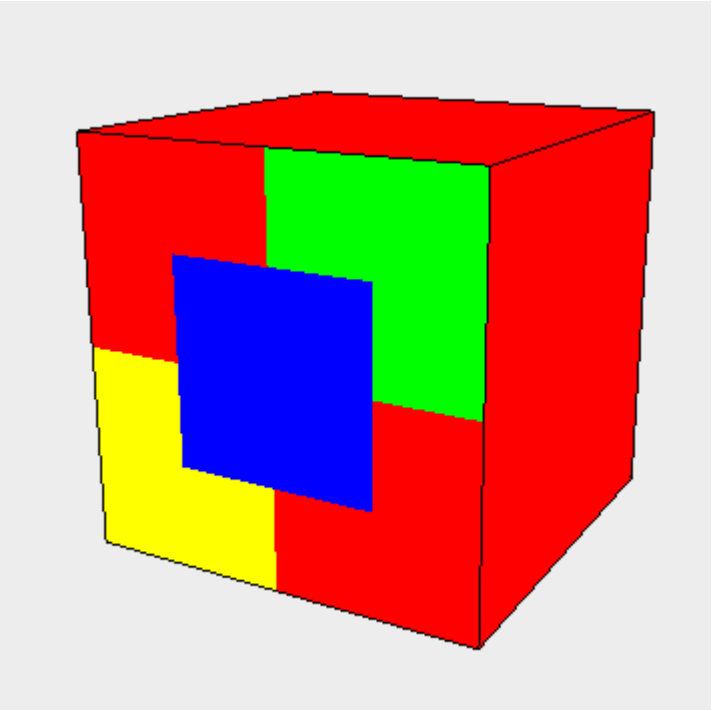
- Sometime it becomes necessary to accentuate the edges of your objects by rendering your object in fill mode and combining it with a line mode (of a different color)
- Normally if this is done you will encounter something called “stitching” happening along the edges of the object; the line with be stitched into the edges



Z-Fighting?

- When two surfaces are together z-fighting can occur





How to Implement Polygon Offset

- glPolygonOffset(-1.0f, -1.0f);
- Follow example program…

Questions?

Resources

- Interactive computer graphics: a top down approach with OpenGL / Edward Angel. ISBN: 0-201-38597-X