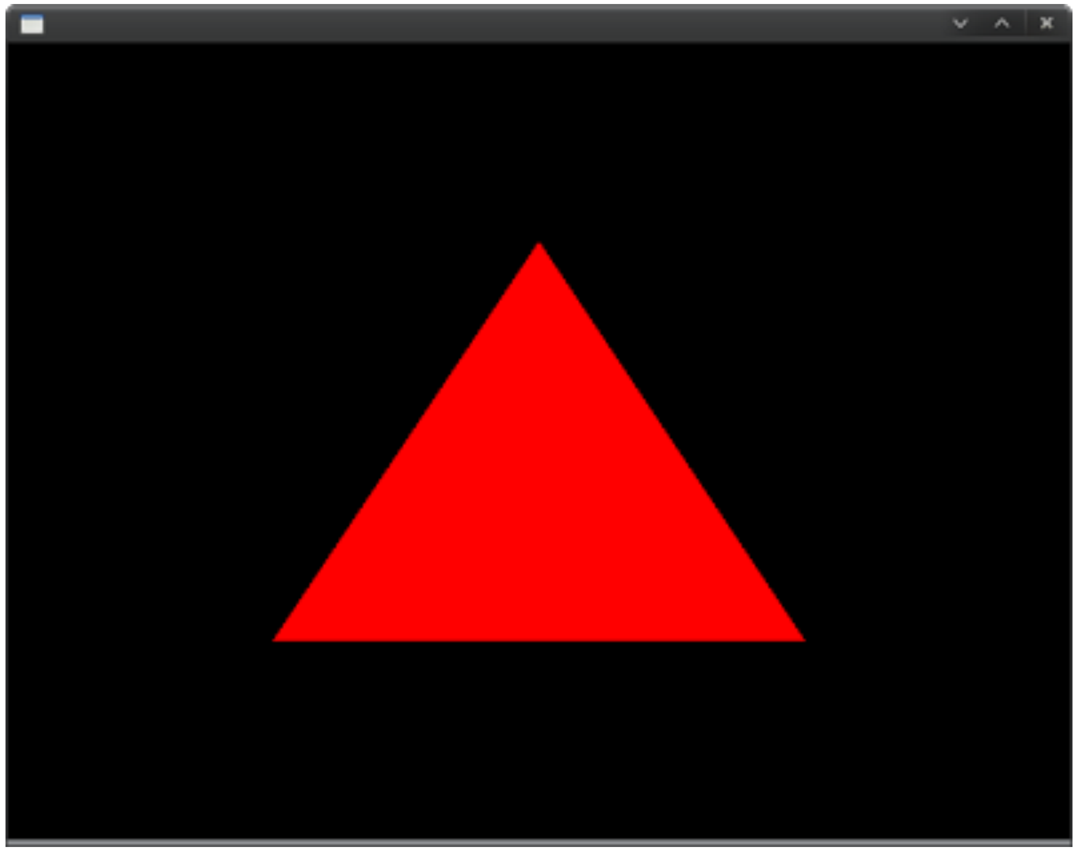
CSC418

Tutorial 1

Topics today

- GLUT
- GLUI
- OpenGL
- “Hello Triangle!”

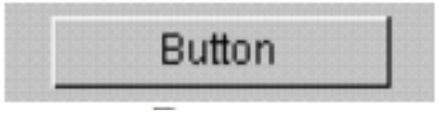


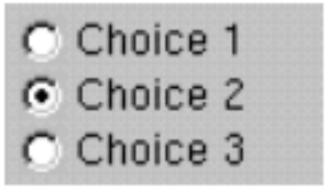
GLUT

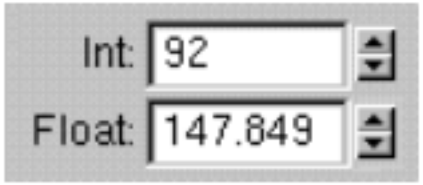
- GLUT is a toolkit that provides basic functions to create windows that we can render to.
- Handles events such as mouse click, keyboard button click, window resizing.
- No buttons, sliders or checkboxes, …

GLUI

- C++ library that provides buttons, spinners, sliders…




○ Choice 1
● Choice 2
○ Choice 3


Int: 92
Float: 147.849

OpenGL

- Graphics Rendering C API.
- Allows us to “talk” to the GPU.
- The API is defined as a set of functions which may be called by the client program.
- Cross platform Windows, OS X, Linux, iOS, Android.

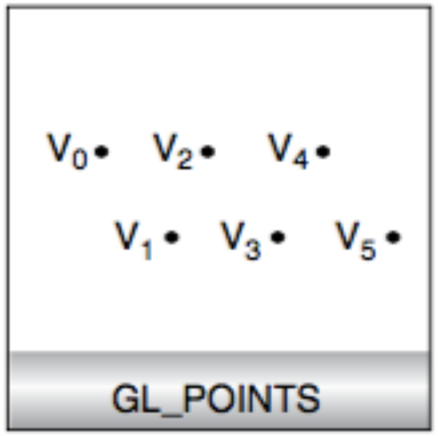
What isn’t OpenGL

- Not a game engine.
- Not a photorealistic rendering API.
- Not object oriented.
- No input, physics.

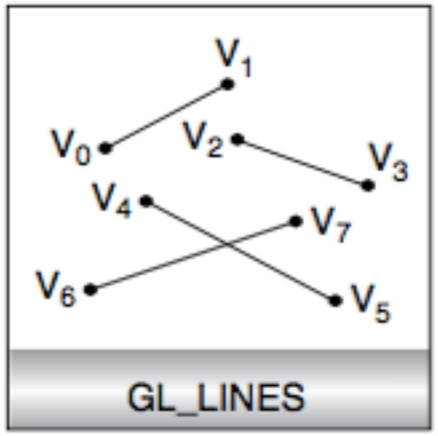
OpenGL 1.x

- Uses Fixed Pipeline State Machine.
- Fixed Pipeline - the math is hardcoded (transformation, shading model, texturing).
- State Machine - You put it into various states (or modes) that then remain in effect until you change them. Can imagine it to be a huge machine with switches. But you don't see internals.

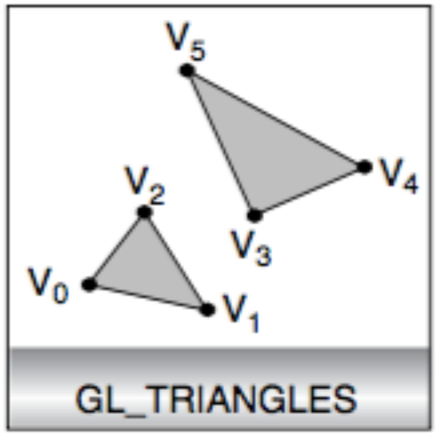
- Renders Geometric Primitives: Triangles, Quads, Lines, Points
- Renders images by means of texture mapping.



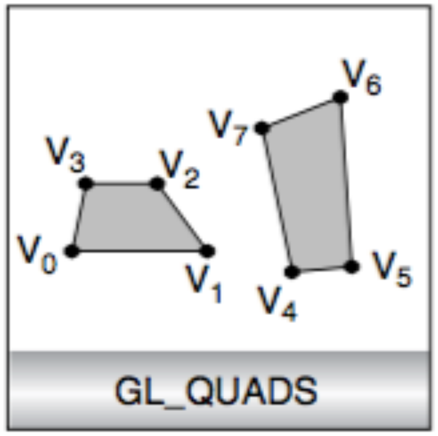
GL_POINTS



GL_LINES

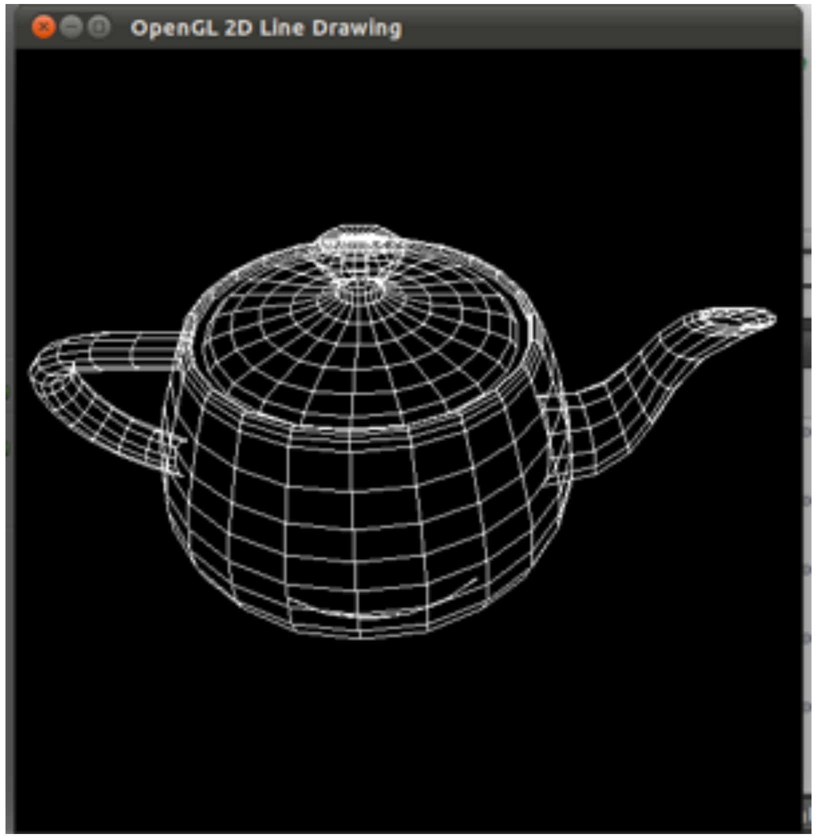


GL_TRIANGLES

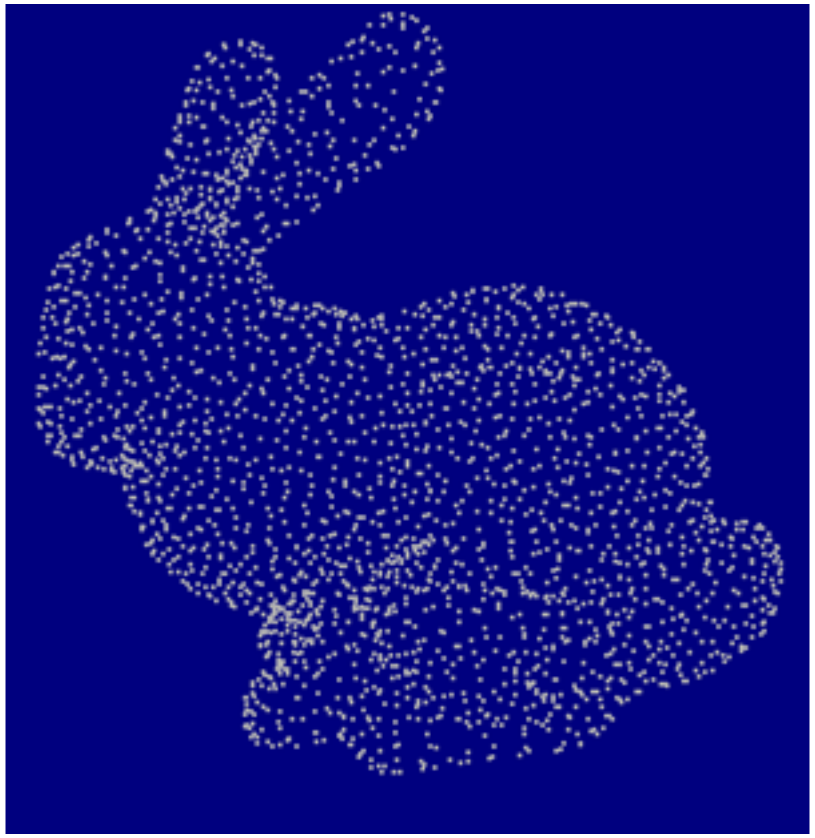


GL_QUADS

Quad or triangle



Lines

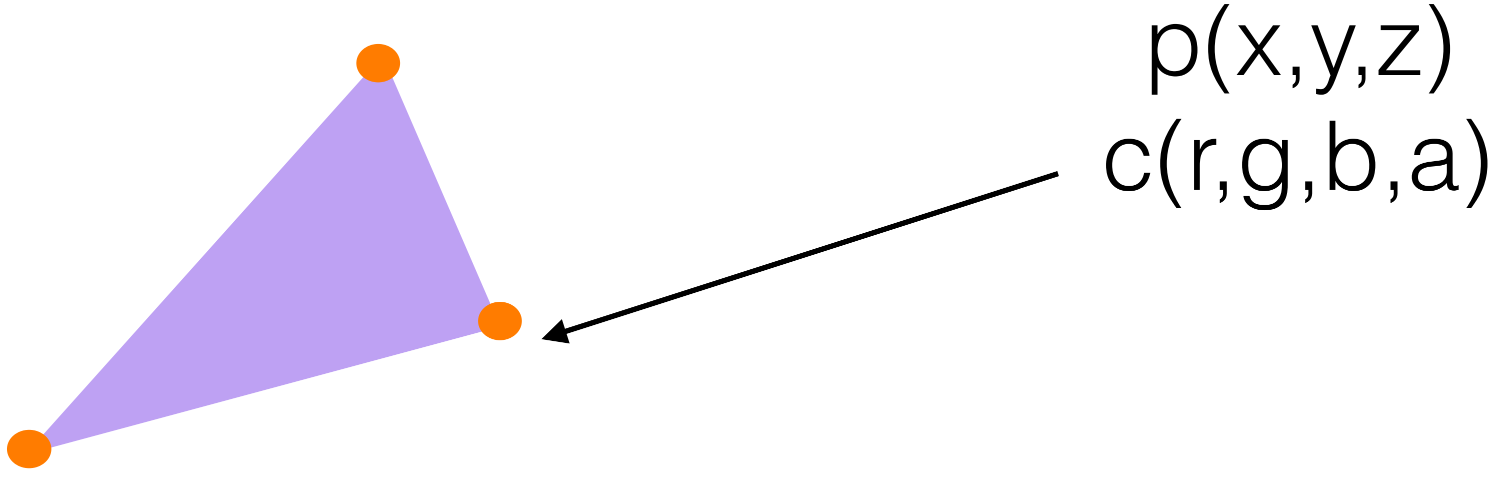


Points

3D scanner

Representing Geometric Primitives

- All primitives represented using vertices.
- Vertex is a collection of attributes: position, color, normal vector, texture coordinates.

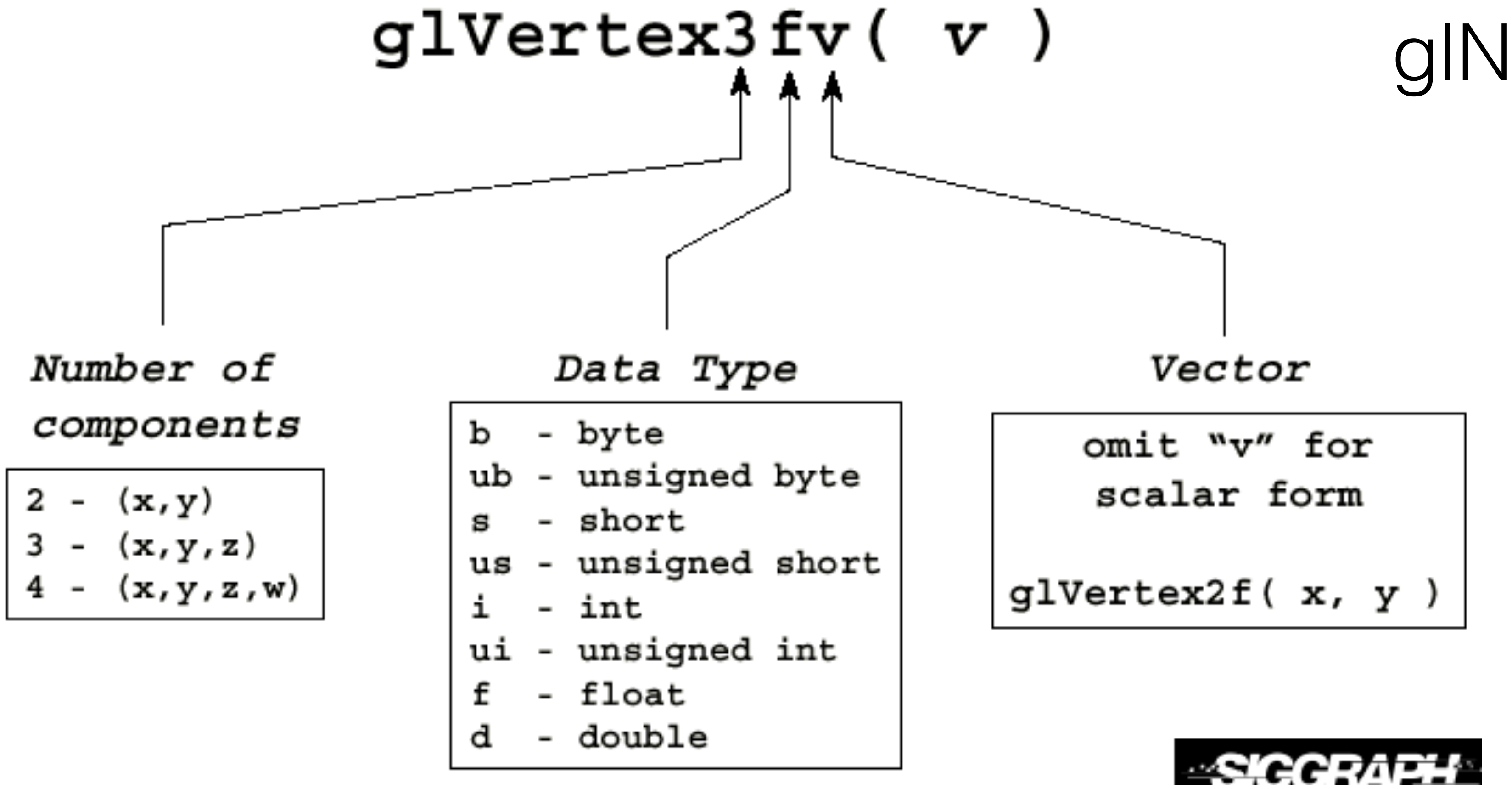


p(x,y,z)
c(r,g,b,a)

OpenGL Command Syntax

prefix

command name



```
glVertex3fv( v )
```

Number of components

2 -	(x,y)
3 -	(x,y,z)
4 -	(x,y,z,w)

Data Type

b	- byte
ub	- unsigned byte
s	- short
us	- unsigned short
i	- int
ui	- unsigned int
f	- float
d	- double

Vector

omit "v" for scalar form

```
glVertex2f( x, y )
```

SIGGRAPH

glColor4f(1.0, 0.0, 0.0, 1.0)

glNormal3f(0.5,0.6,0.7)

Controlling state

Setting State

```
  glPointSize( size );
  glLineWidth( size );
```

Enabling Features

```
  glEnable( GL_ LIGHTING );
  glDisable( GL_TEXTURE_2D );
```

Rendering primitives

Draws White Triangle (white is default color)

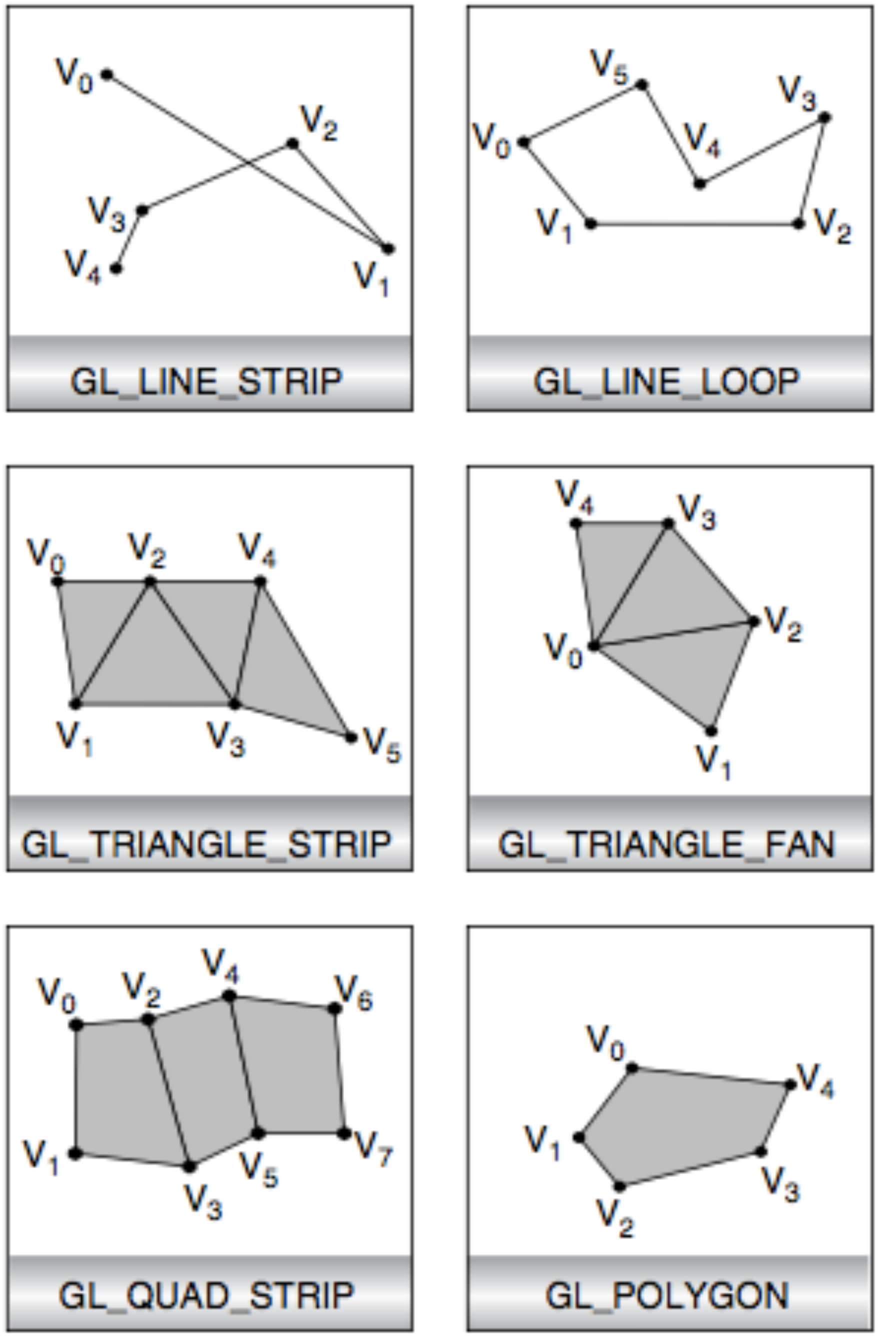
```
glBegin(GL_TRIANGLES);
     glVertex2d(0.0, 0.0);
     glVertex2d(0.0, 150.0);
     glVertex2d(150.0, 150.0);
 glEnd()
```

Rendering primitives

Draws Red Triangle

```
glBegin(GL_TRIANGLES);
     glColor3f(1.0,0.0,0.0,1.0);
     glVertex2d(0.0, 0.0);
     glVertex2d(0.0, 150.0);
     glVertex2d(150.0, 150.0);
 glEnd()
```

Other primitives


V0
V2
V3
V4
V1
GL_LINE_STRIP
V5
V3
V0
V4
V1
V2
GL_LINE_LOOP
V0
V2
V4
V1
V3
V5
GL_TRIANGLE_STRIP
V4
V3
V2
V0
V1
GL_TRIANGLE_FAN
V0
V2
V4
V6
V1
V5
V7
V3
GL_QUAD_STRIP
V0
V4
V1
V3
V2
GL_POLYGON