

# CS130 Exam 1 Material Outline

February 7, 2013

## **All homework problems**

### **Labs**

Lab 1 : OpenGL basics

Lab 2 : DDA

Lab 3 : Transformations

- matrix stack

Lab 4 : Programmable shaders

### **Assignment 1: Mini Pipeline**

- Barycentric coordinates
- Barycentric interpolation
- Rasterization
- z-buffer
- camera, projection, and viewport transformations

### **Lecture 1**

- Areas of graphics: modeling, rendering, animation, simulation
- Global vs. Local Illumination
- General concepts:
  - antialiasing
  - flat vs. smooth shading
  - texture mapping
  - shadows
  - motion blur and accumulation buffer
- OpenGL state machine
- OpenGL command syntax
- gl, glu, glut
- Math review
  - points vs. vectors
  - dot product
  - cross product
  - linear vs. affine

### **Lecture 2**

- Raster Devices and Images
- Transmissive vs. Emissive Display
- Images

- Monitor Gamma and gamma correction
- Additive vs. Subtractive color
- alpha channel
- Graphics pipeline
- z-buffering
- valid polygons
- pipelining
- Graphics pipeline and major steps  
(vertex proc, clipper and primitive assembler, rasterizer, fragment processor)

### **Lecture 3**

- object vs. image oriented rendering
- Rasterizer transforms primitives to fragments, interpolates attributes, and enumerates pixels
- eqtn of lines, parametric eqtns
- implicit line eqtn, decision variable d
- midpoint algorithm
- Barycentric Coordinates

### **Lecture 4**

- Triangle rasterization issues and shared edge conflicts
- Barycentric
- Transforms:
- -modelview
- transform, project, clip in geometric pipeline before rasterizers
- Orthographic projection
- Perspective viewing
- Clipping against view volume and planes (use intersection of line w/plane, then make new triangles)

### **Lecture 5**

- occlusion
- painter's algorithm
- z-buffer
- backface culling (just one picture)
- Transformation Matrices
- Scaling (uniform/nonuniform), rotation, reflection, shear, translation
- ops are noncommutative

### **Lecture 6**

- Viewing transformations (world to image space)
- CVV is always -1,1
- Viewport transform
- Orthographic transform
- Camera Transform (Orthogonal Case)
- (eye position, gaze direction, up vector)
- w, u, v formula
- Perspective viewing
- rigid
- affine

- perspective
- Projective transformations
- clipping after perspective transformation problematic

### **Lecture 7**

- Shading
- General rendering
  - surfaces either emit or reflect light
- Rendering equation
- local shading vs. global shading
- Global effects (translucency, multiple reflection, shadows)
- Specular, diffuse, ambient light
- Generalized light source
- Idealized light sources (ambient, point, spotlight, directional/dist light)
- Lambertian reflection model (reflectance, illumination, cosine proportionality)
- Ambient reflection
- Phong reflection model

### **Lecture 8**

- Flat, Smooth (Gourard) and Phong shading
- Mach band effect (makes flat shading look even worse)
- Smooth shading (once per vertex)
- Interpolating normals (must renormalize)
- Using barycentric coordinates for interpolation / Goureaud shading
- Phong shading (once per fragment)
- 3 way comparison
- Problems with interpolated shading
- Programmable shading
- Plane Normals
- Implicit function normals
- Parametric form