# CS130 Exam 1 Material Outline

## All homework problems

## Labs

- Lab 1 : OpenGL basics
- Lab 2 : Rasterization: DDA, Midpoint algorithm
- Lab 3 : Transformations, matrix stack
- Lab 4 : Programmable shaders

## Assignments

- Assignment 1: Mini Pipeline
  - Barycentric coordinates
  - Barycentric interpolation
  - Rasterization
  - z-buffer
  - camera, projection, and viewport transformations

## Lectures

- 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

- painters algorithm
- z-buffer
- backface culling (just one picture)
- Transformation Matrices: scaling (uniform/nonuniform), rotation, reflection, shear, translation
- matrixl mult is associative, but not noncommutative

- Lecture 6

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

3

- 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