Course Review

COMP 3003
Autumn 2005

Day-by-day Review

- NOT a substitute for your own review
- Exam material can come from anywhere
- But here is *one* view of what's important
  - RED points are crucial

Overview of Slides

- Day 1: Introduction
- Day 2: Physics / Biology
- Day 3: 2D Geometry
- Day 4: Rasterization
- Day 5: 3D Geometry

Overview of Slides

- Day 6: Geometric Modelling
- Day 7: Geometric Transformations
- Day 8: Animation
- Day 9: Perspective Projection
- Day 10: The Projective (OpenGL) Pipeline

Overview of Slides

- Day 11: Colour & I/O Devices
- Day 12: Lighting
- Day 13: Textures
- Day 14: Project Discussion
- Day 15: Blending & Compositing

Overview of Slides

- Day 16: OpenGL Effects
- Day 17: OpenGL Optimization
- Day 18: Geometric Optimization
- Day 19: Curves & Surfaces
- Day 20: Image Analysis

Day 2: Physics/Biology

- Emission, Reflection, Absorption of Light
- RGB Cones & Tri-stimulus Theory
- Alberti's Window
- Digital Images
- Raytracing

Day 3: Geometry in 2D

- Scalars, Points & Vectors
- Cartesian Coordinates
- Vectors & Vector Operations
  - Length, Dot Products, Normalization
- Equations of Lines
  - Explicit, Implicit, Normal, Parametric

Day 4: Rasterization

- Rasterizing Lines
  - Explicit (Bresenham's), Implicit, Parametric
- Linear Interpolation of Colour
- Approximating Curves with Lines
- Rasterizing Triangles
  - Raster Scan (E), Half-Plane (I), Barycentric (P)

Day 5: 3D Geometry

- Cross-Product & Normal Vectors
- Equations of Lines in 3D (no normal form)
- Parametric Curves
- Equations of Planes in 3D
  - Explicit, Implicit, Normal & Parametric

Day 6: Geometric Modeling

- Constructive Solid Geometry (CSG)
- Rendering Styles
  - Points, Wireframe, Flat, Smooth
- Building Objects from Primitives
  - Polygons, Polyhedra, Platonic Solids
  - Round Objects

Day 7: Transformations

- Changing Bases
  - Rotation, Shearing, Scaling, Reflection
  - Translation (by addition)
- Perpendicular Projection
  - Orthographic, Oblique

Day 8: Animation

- Double-Buffering
- Articulation, Joints and Bones
- Bone Hierarchy & Stack Representation
- Generating Poses

Day 9: Perspective

- Homogeneous Coordinates
  - Definition, Conversion, Transformations
- Perspective Projection
  - 1-, 2-, 3- Point Perspective
  - Perspective Projection Matrix
  - Foreshortening
  - View Frustum

Day 10: OpenGL Pipeline

- Coordinate Systems:
  - OCS, WCS, VCS, CCS, NDCS, DCS
- Projective Rendering / Painter's Algorithm
- Projective Pipeline Diagram
- OpenGL State & Matrices
- Vertex Definition & Operations

Day 11: Colour & I/O

- Tri-stimulus Theory
- RGB Coordinates
- XYZ, CIE, YUV, HSV, CMYK Coordinates
- Additive vs. Subtractive Colour
- Colour vs. Material in OpenGL

Day 12: Lighting

- Light Sources
- Phong Lighting Model
  - Specular, Diffuse & Ambient Reflection
- GL_NORMALIZE
- Flat vs. Smooth (Gouraud) shading

Day 13: Textures

- Definition of Texture
- Texture Coordinates
- Clamping & Repeating
- Interpolation
- Replacing & Modulation

Day 14: Project

- Moving the Camera
  - Relativity
  - Accumulated Motion

Day 15: Blending

- The Frame Buffer(s)
  - Double-Buffering & Depth-Buffering
  - Stencil & Accumulation Buffers
- Fragment Operations
  - Scissor, Alpha, Stencil, Depth Tests
- Alpha Transparency

Day 16: OpenGL Effects

- Aliasing & Anti-Aliasing
- Motion Blur
- Depth of Focus
- Fog & Haze
- Shadows
- Polygon Offset

Day 17: Optimization

- Optimization
- Bus Speed, Transform Rate, Fill Rate, Bottlenecks
- Rendering Modes & Display List
- Reusing Vertices: Loops, Strips, Fans, Arrays

Day 18: Geometric Optimization

- Clipping & Culling
- Simplification
- Level of Detail
- Billboards

Day 19: Curves & Surfaces

- Continuity & Smoothness
- Hermite Curves
- Bézier Curves
  - de Casteljau Algorithm
- B-Splines

Day 20: Image Analysis

- Image Features & Statistics
- Histograms & Transfer Functions
- Filter Masks & Edge Detection
- Sharpening & Blurring
- Spatial Frequency

Constructing Exams

- Always test the essentials
  - Coordinates, Perspective, Pipeline
  - Animation, Lighting, Textures
- Test a selection of the optionals
  - Everything else

Final Exam

- 6 mandatory questions
- 4 out of 6 optional questions
- Sample Exams will be provided

Time Management

- 2 hours = 120 minutes
- 20 day lectures = 6 minutes / lecture
  - on AVERAGE
  - more time on essentials
  - less time on optionals

Questions & Parts

- Questions should be divided into parts
  - all parts should be related
  - but not dependent
    - i.e. failure to answer (a) should generally not make answering (b) impossible

Definition Questions

- What is the tri-stimulus theory, and why is it important?
- What is a cross product, and what do we use it for?
- What are the principal coordinate systems and how are they related?

Working Questions

- Small examples that need working through
- Realistically, no more than 5 minutes each
  - Vanishing Points, Matrix Composition, Projection Matrix, Hierarchical Matrices, Painter's Algorithm (maybe), Interpolation / Rasterization, Compositing, Triangle Strip Construction, Backface Culling, de Casteljau Algorithm

Code Questions

- E.g. "How do we apply a texture in OpenGL"
  - more interested in general principles than actual code
- E.g. "Write code to generate a cylinder with normals, texture coords, &c."
  - Again, pseudocode is sufficient

Remember . . .

- I don't want people to fail