COSC 414/519I: Computer Graphics

2023W2

Shan Du

Final Exam

- Information:
  - 8:30AM, Monday Apr 22, 2024
  - Duration: 2.5 hours
  - In-person, ART 366
  - Paper-based, closed-book test with cheat sheets allowed
  - Check ID
  - Covers Lecture 1 to Lecture 23
  - 20 multi-choice questions and 10 short/long answer questions

Final Exam

- If you have DRC accommodation, please register with DRC.
- Please do not forget to bring enough pens, pencils, erasers, and blank scratch papers.

Final Exam

Instructions:

1. Bring your UBC card or any government-issued photo ID.
2. REFERENCE MATERAL AND CALCULATORS: You may bring a maximum of 16 (one side) or 8 (both sides) pages (8.5 by 11 inches, photo-reduction allowed) and any basic scientific calculator you wish (but NO other electronic equipment such as a laptop, portable computer, printing devices, communication devices, etc.)
3. Students are expected to abide by UBC's rules and regulations for academic integrity during both online and in-person final examinations: https://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,293,861,0#11072

Contents

- Introduction
- Transformation
- Projection
- Shading
- Texture Mapping

Introduction

- Slides1_Introduction
- Slides2_ImageFormation
- Slides3_Programming1 (~~pp. 1-18~~)
- Slides4_Programming2 (~~pp. 19-42~~)
- Slides5_Programming3 (~~pp. 1-19, 25-32~~)
- Slides6_Interaction (~~pp. 14-40~~)

Introduction

- What is graphics and its applications?
- Rasterization
- Framebuffer
  - Resolution
  - Precision (depth)
- Imaging system
- Synthetic camera model

Introduction

- Clipping window
- Image formation and light
- Recursive subdivision – Sierpinski gasket
- Primitives
- Color
- Orthographic view
- Default viewing volume

Transformation

- Slides7_Primitives
- Slides8_Frames
- Slides9_Transformations (~~pp. 33-41, 51-55~~)
- Slides10_TransformationsWebGL (~~pp. 11-30~~)

Transformation

- Vectors and operations
- Affine sum
- Planes
- Change of basis
- Homogeneous coordinates
- Affine transformation and matrices
- Concatenation of transformations
- Arbitrary fixed point and arbitrary axis

Projection

- Slides11_Viewing
- Slides12_Projections1
- Slides13_Projections2
- Slides14_HiddenSurfaceRemoval

Projection

- Parallel projection
- Perspective projection
- Position the camera
- Viewing volume/clipping volume
- How to form an arbitrary projection
- Hidden surface removal

Shading

- Slides15_Lighting
- Slides16_Reflection
- Slides17_Shading1
- Slides18_Shading2
- Slides19_LightingCalculation

Shading

- Material
- Light source
- Phong model
- Reflection
- Modified Phong model
- Polygonal shading
- Recursive subdivision – sphere/circle

Texture Mapping

- Slides20_TextureMapping1
- Slides21_TextureMapping2
- Slides22_TextureMapping3
- Slides23_TextureMapping4

Texture Mapping

- Texture mapping
- Bump mapping
- Environment mapping
- 2-step mapping
- Aliasing
- Mipmapping

Sample Questions

- Using homogeneous coordinates, suppose a vector $w = 4v_1 + 5v_2 + 6v_3$ is in the basis system $\{v_1, v_2, v_3\}$, convert it to a new basis system $\{u_1, u_2, u_3\}$ where

$$u_1 = v_1$$

$$u_2 = v_1 + v_2$$

$$u_3 = v_1 + v_2 + v_3$$

The origins of the two systems are same.

Sample Questions

- List major uses of dot product and cross product of vectors in computer graphics and sketch how to use them.

Sample Questions

- Consider an orthogonal view volume with (left, bottom, -near) given by (2, 4, -5, 1) and (right, top, -far) given by (8, 9, -15, 1) where near and far are measured from the camera.

What transformation using homogeneous coordinates will center this view volume at the origin?

Sample Questions

- What is the per-vertex shading and what is the per-fragment shading?