## THE UNIVERSITY OF CALGARY DEPARTMENT OF COMPUTER SCIENCE

## **ENEL/CPSC 555**

## Mid-Term EXAM

## November 8, 2000

Closed Book, calculators are permitted. The questions carry equal weight. Attempt all questions (out of 24).

- 1. (a) What is meant by *range space* and *parameter space* for B-Spline curves?
  - (b) What is the one case where  $C^n$  continuity does not imply  $G^n$  continuity?
  - (c) Show that the two parametric curves given below are  $C^0$  and  $C^1$  continuous. Are they  $C^2$  continuous?

$$\begin{array}{rcl} f_1(t) &=& -2t^3 \;+\; 3t^2 \\ f_2(t) &=& 2t^3 \;-\; 3t^2 \;+\; 1 \end{array}$$

- 2. A display system consists of a 6 bit/pixel frame buffer that addresses a colour table. Each entry of the colour table is associated with the gun drives of the display, by using 5 bits for red, 5 bits for green and 6 bits for blue.
  - (a) How many colours are simultaneously displayable ?
  - (b) What size of pallette are the displayable colours chosen from?
  - (c) If the frame buffer had only 3 bits/pixel show how the colour table and frame buffer could be set up to show a blue cross over a red circle over a green diagonal line.
- 3. Design a simple 2D model of a four legged creature. Describe the data structure and transformations which have to be made to animate the creature, so that by rotating a leg to make a step, the body will move by the appropriate amount. Don't worry about knee joints, make the system simple.
- 4. (a) Given a 3D viewing system, the near plane is set to 5 and the far plane is set to 20. Calculate the mapping that takes the  $Z_e$  coordinate and maps to  $Z_s$ . Use the mapping,  $Z_s = \alpha + \beta/Z_e$ 
  - (b) Give an example of artifacts that are likely to be observed in scenes that use large polygons with the perspective viewbox transformation. Explain why these artifacts are likely to be visible.
- 5. (a) Given the curve:  $f(t) = 4t^2 + 5t 3$  find expressions for the forward differences that would be required to iterate along the curve.
  - (b) Briefly describe how you use these forward differences to compute successive points along the curve.
- 6. (a) What properties must a geometric transformation matrix possess to be classified as a) orthogonal b) affine?
  - (b) How may a shape preserving geometric transformation be inverted?
  - (c) It is desired to rotate a model of a dinosaur around its own axis by 45 degrees in a clockwise direction. If the model is defined so that its axis is aligned with the *X*-axis, describe the steps that need to be taken to perform this rotation.