CMPT 3501 Midterm Exam

November 5, 2009

75 Minutes. 100 marks. 3 pages. Read each question carefully. Answer succinctly: a portion of marks awarded are for style and clarity.

You may refer to a sheet of notes you brought with you.

1. [10] Explain the Z-buffer algorithm, with particular attention to (a) what problem the algorithm is trying to solve, and (b) its advantages and disadvantages.

2. [10] Explain the function of the rasterization and interpolation stages of the graphics pipeline. Be as specific as possible.

3. Briefly respond to the following. Show work if applicable. If you do not have a calculator, then in any of these questions, you may express your answer in terms of evaluations of arithmetic and trigonometric functions.

3a. [5] Given vectors $\vec{u} = -4j + 2k$ and $\vec{v} = i + 2j - 3k$, what is $\vec{u} \cdot \vec{v}$?

3b. [5] Given vectors $\vec{s} = -2i + 3j + 4k$ and $\vec{t} = -2i + 8j - 3k$, what is the angle between $\vec{s}$ and $\vec{t}$?

3c. [5] Give the RGB values for a warm yellow color. Assume a range of 0-1.

4. [10] Explain two applications of homogeneous coordinates in computer graphics.

5. [20] Write a unit quaternion that expresses the compound rotation of 45 degrees about the axis (1,2,3), followed by a rotation of 30 degrees about the axis (-1,-1,1).

6. [15] Your team wants to build a particle system to represent an electrical force field effect.
(a) Describe the major design issues you will encounter in building this particle system and give a one-sentence preliminary decision for how to resolve each issue.
(b) Are particle systems a good choice for this effect? Describe an alternative, and list at least one advantage and disadvantage for the particle systems approach and for your alternative approach.

7. [20] Consider a triangle with vertices $\vec{a}, \vec{b}, \vec{c}$, lit by a directional light whose direction is $\vec{L}$. Write a formula for the direction of reflection for a light ray striking the triangle. (You need not consider where within the triangle a light ray strikes.)

8. [1, bonus] What was your favorite demo so far in class, and what did you like about it? (Just one sentence.)