EECE 478: Midterm Exam
October 24, 2006
Closed book. 60 pts = 60 minutes

Name:
Student #:

**Instructions:**

Write clearly and concisely. A clear explanation of your answer is necessary for full or partial marks. Write all responses on the examination paper.

1. [15 pts] The plane equation $A \bullet P = 0$ where $A = [x\ y\ z\ w]$ is a staple of linear algebra.

    a. [8 pts] Compute A for the plane of all points P defined by $(P\text{-}P_0) \bullet \mathbf{n} = 0$, where $\mathbf{n} = [n_x\ n_y\ n_z\ 0]$ and $P_0 = [x_0\ y_0\ z_0\ 1]$.

    b. [2 pts] How can A be used to define a half-plane?

    c. [5 pts] How can a set of such half-planes be used for visual culling? Draw a diagram to illustrate.

2. [15 pts] Consider the triangle ABC and a half-plane defined by $x \leq 1$. Call the intersection points of the line segments AB, BC, and CA with line $x = 1$, A', B' and C' respectively.

    a. [6 pts] How can we use these to compute the shape that results from clipping ABC on this half-plane? Use an example to illustrate.

    b. [9 pts] Describe a pipeline made up of half-plane clippers similar to the one in 2a) that will clip ABC against the Canonical View Volume. (*This is called the Sutherland-Hodgman clipping algorithm*).

3. [15 pts] Using the Phong Lighting Model:

    a. [8 pts] Name and describe the vectors **l**, **n**, **r**, and **v** used in the lighting model. Draw a diagram if you wish.

    b. [7 pts] Use these vectors to calculate the ambient, diffuse, specular and emissive components of the Phong Lighting Model.

4. [15 pts] Alpha blending associates a value $\alpha$ with colors or pixels in graphical models.

    a. [3 pts] Write the alpha-blending equation and name the components that it uses.

    b. [9 pts] Describe three scene creation techniques that use alpha blending.

    c. [3 pts] Why is alpha blending considered to be costly and should be turned off when not actively being used?