

Breath Exam

Computer Graphics

Spring 2011

There are 9 questions in this exam. Read through all questions before you start writing. If you think a question is unclear without making some assumption, write down the assumption.

Last 4 digits of your student ID: _____

1. What are the differences between flat shading, gouraud shading, and phong shading of polygons?

2. You are given a coordinate system that has been transformed with respect to the world coordinate system. The transformation matrix is:

$$M = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 0.8 & -0.6 & 1 \\ 0 & 0.6 & 0.8 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

What are the coordinates of the point $(1, 1, 1)^T$ in the transformed coordinate system?

3. Write the pseudo-code implementing a z-buffer algorithm for hidden surface removal.

4. What is the difference between parallel and perspective projections? Describe an application where each type of projection would be preferable.

5. The parametric equations for a line between $(x_0, y_0, z_0)^\top$ and $(x_1, y_1, z_1)^\top$ are:

$$x(t) = x_0 + (x_1 - x_0)t$$

$$y(t) = y_0 + (y_1 - y_0)t$$

$$z(t) = z_0 + (z_1 - z_0)t$$

for $t \in [0, 1]$. Calculate the coordinates of the point of intersection of a line between $(1, 2, 3)^\top$ and $(9, 12, 13)^\top$ with the $x = 5$ plane.

6. Give the equations of Phong shading model including ambient, diffuse, and specular components. Draw a picture to show the vectors that are the main components of the equation.

7. Show the steps for calculating a specular reflection vector on a surface.

8. Which are the main principles behind environment mapping and what is the visual effect obtained?

9. Consider the following figure. Give a matrix, or product of matrices, that will transform the square ABCD into the rectangle A'B'C'D'.

