

Name: \_\_\_\_\_ Student ID: \_\_\_\_\_

Write your answers in the spaces provided.

No aids (books, notes, calculators, mobile phones, PDA's, music players, other electronic devices, etc.) are permitted.

1) Write down an explicit description as well as an implicit description of the line (in 2D) that passes through two distinct points  $\vec{x}_0 = (x_0, y_0)$  and  $\vec{x}_1 = (x_1, y_1)$ .

2) Determine a bounding box for a circle with centre  $(2, 5)$  and radius 1.

3) Given a triangle with vertices  $(x_0, y_0)$ ,  $(x_1, y_1)$  and  $(x_2, y_2)$  and the usual edge functions such as  $F_{01}(x, y) = (x_1 - x_0)(y - y_0) - (x - x_0)(y_1 - y_0)$ , detail how to compute the barycentric coordinates of a point  $(x, y)$ . In particular, identify  $\alpha$  as the barycentric coordinate corresponding to vertex 0,  $\beta$  for vertex 1, and  $\gamma$  for vertex 2.

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4) How can you construct a right-handed orthonormal 3D basis with a given unit-length  $\vec{r}$  as its first vector?

5) Determine a model-view transformation corresponding to a camera with world space coordinates  $(5, 0, 5)$ , pointing at the origin of world space. You can express this as a sequence of named transformations (e.g. rotate around this axis by this angle) or if you prefer as a  $4 \times 4$  matrix.

6) The projection transformation maps points from which coordinates system to which other coordinate system?

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7) What is the difference between the view volume for an orthographic and a perspective projection?

8) Why is it important to specify a near clipping plane for a perspective projection?

9) How is the  $z$ -divide of perspective projection attained using matrix multiplication?

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10) Write recursive pseudo-code for rendering a hierarchical model.

11) Sketch a configuration of triangles for which the painter's algorithm fails. How can it be fixed?