

## CS4731- A Term '01 - Midterm Exam

Name and Login ID:

Read questions carefully before answering. Do not hesitate to ask for clarification. Show all work. Partial credits are given, so do not leave anything blank! Use the back of the pages or extra paper as needed. Good luck!

1. (20 pts) Show that premultiplication and postmultiplication will result in the same transformation by transforming the point  $(x, y, z)$  by a rotation of  $\alpha$  degrees about the z-axis followed by a translation of  $(\Delta x, \Delta y, \Delta z)$ . Be sure to show all 4 by 4 matrices involved, and convert the point into either a 1 by 4 matrix (premultiply) or a 4 by 1 matrix (postmultiply).

2. (20 pts) Give brief definitions for the following terms as they are used in the field of graphics:

- View Reference Point
- Skew transformation
- Callback functions
- Window
- Convex Polygon

3. (20 pts) Give the two equations of a plane that go through the points  $(2., 2., 2.)$ ,  $(4., 3., 2.)$ , and  $(5., 1., 5.)$ .

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4. (20 pts) Chose **one** of the following objects and write a pseudo-code module for generating a model (vertices and surfaces) of the object. Make sure all basic components are triangles, and that you create a complete model (i.e., no holes or missing sides).

- a. A tube of constant radius, with a square cross-section at the base and a circular cross-section at the top.
- b. A cylinder that has been damaged, i.e., the cross-sections are not perfectly circular, and the top surface may not be parallel to the bottom. Note you do not have to guarantee preservation of surface area.

5. (20 pts) Describe the hierarchical modeling of an object of your choosing (other than a space ship) that would require at least 4 levels of the hierarchy. Indicate what objects would be at each level, and what transforms (no, you don't have to give the matrices) would be involved to instantiate the different components. Also indicate where components could be reused, such as with the engines of your space ship.