CS 480/680 Computer Graphics

Sample Midterm Exam

Duration: 1 hr

Name: **Student Number:**

1. **[20 pts]** For each of the following statements, indicate whether it is true or false.

   T F Both raster and vector displays represent images as pixmaps which are stored in the frame buffer.
   T F Raster displays can produce smoother lines compared to vector displays because they have higher resolution.
   T F The inverse of a rotation matrix is its transpose.
   T F The parametric line-clipping algorithm is always more efficient than the Cohen-Sutherland algorithm.
   T F The midpoint algorithm can scan convert lines of any slope.
   T F Every rigid transformation is also an affine transformation.

2. **[10 pts]** What are the main differences between sample mode and event mode ?

3. **[15 pts]** Prove that 2-D rotation and scaling commute if $s_x = s_y$ or if $\theta = n\pi$ for integer values of n, and that otherwise they do not.

4. **[15 pts]** Consider the 2-D line segment from (-4,0) to (2,1) and a clipping window defined by the unit square (i.e., with vertices (0,0), (1,0), (1,1), and (0,1)).

(a) Give the parametric form of the equation of the line segment, $P(t)$, where t ranges between 0 and 1.

(b) Find the value of t for the intersection of the line with each edge of the clipping area.

(c) Classify each value of t in (b) as potentially entering (PE) or potentially leaving (PL), according to the Cohen-Sutherland algorithm (justify why).

5. **[20 pts]** Find the sequence of matrix transformations that will perform a rotation by θ radians about the line passing through the points (0,0,0) and (3,4,0). Multiply the matrices into one composite transformation (looking down the line from (3,4,0) to the origin, the object should rotate in the counter clockwise direction).

6. **[20 pts]** The scan line polygon fill algorithm begins by creating a table of information from the polygon's edges.

(a) Given and edge from (7,1) to (13,5) determine *what* information you should store and *where* you should store it in the table.

(b) Given active edge list below for scan line 9, determine which pixels are inside the polygon.

scan line 9: (9,2,0)-->(9,2,-5/2)-->(11,10,3/2)-->(11,13,0)

(c) Determine the active edge list for scan line 10, assuming that no new items are added from the table.