# COM1370 Spring 2003 Final Exam -- Prof. Futrelle

## Tuesday 3 June - Closed book/notes

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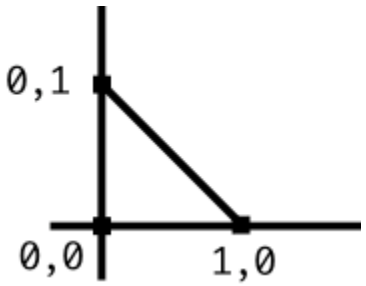
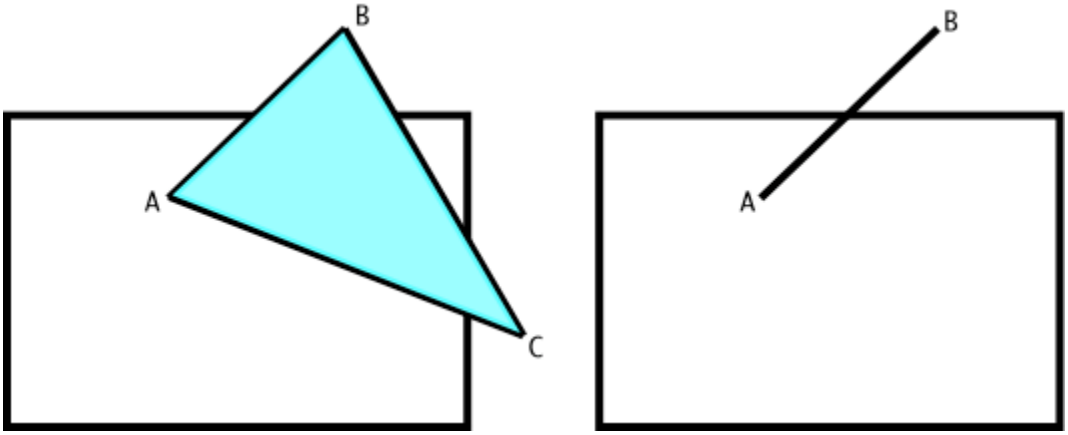
**Question 1. Homogeneous 2D transforms:** The figure to the right shows a triangle at the origin. The matrix shown is a composite M of a 2D translation T to the right by 5 units and a 2D rotation R by +**ΠΠ**/2. Apply the matrix to the three vertexes of the triangle and draw the transformed triangle. Write out the column vectors for each vertex and show your work. Explain the order in which the two transforms must have been done. That is, does M=RT or M=TR?




$$\begin{bmatrix} 0 & -1 & 5 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

**Question 2. Line and polygon clipping:** In the figure below, the line AB on the left is the edge of a polygon, whereas the identically placed line AB on the right is simply a line to be clipped. Explain carefully how the clipping algorithms work differently for the two cases. (Assume that the Sutherland-Hodgman algorithm is used for polygon clipping and the Cohen-Sutherland algorithm is used for line clipping, just as we have earlier in the course.)




**Question 3: Illumination:** Below is the basic equation with some labels that you'll need to identify and explain.

$$I = k_a I_b + k_c I_d (\mathbf{N} \cdot \mathbf{L})$$

a. What is "$I$" on the left hand side of the equation?

b. The first term, $k_a I_b$, consists of two factors. Explain the significance of the term and what the two factors are and what roles they play. What are the conventional labels for `a` and `b` and what do they mean? What is the acceptable range of values for $k_a$ and why?
c. What is the overall significance of the second term, $k_c I_d$(**N·L**)?
d. What are the conventional labels for `c` and `d` and what do they mean?
e. Explain the structure and role of the term **N·L** and its two components.
f. Consider the following values **N** = `{sqrt(2)/2,sqrt(2)/2}` and **L** = `{1,0}`. Draw a diagram of the surface, etc., based on these values. Compute the value of **N·L**.

**EXTRA CREDIT Question 4: RGB Color:** Bright yellow has the RGB values, for one byte per color, of {255,255,0}. Write out and explain typical RGB values that would correspond to the following colors: (a) Light or pale yellow (b) Dark yellow (c) "Distant yellow" that would be fading to gray.

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Have a great summer and a long and happy life!