

CS 130, Homework 4

Name: _____ ID: _____

Problem 1

When computing the eye coordinate system, we used $\mathbf{w} = -\frac{\mathbf{g}}{\|\mathbf{g}\|}$, $\mathbf{u} = \frac{\mathbf{t} \times \mathbf{w}}{\|\mathbf{t} \times \mathbf{w}\|}$, and $\mathbf{v} = \mathbf{w} \times \mathbf{u}$. Why did we not normalize \mathbf{v} ?

Problem 2

Label each table entry below “Y” or “N” to indicate whether the operation preserves each feature.

	rotation	nonuniform scale	translation	shear	projection	affine
parallel lines						
angles						
distances						
intersections						
lines						
circles						
conic sections ¹						

Problem 3

Are projective transformations linear? Why? Justify your answer.

Problem 4

Explain why clipping triangles after switching from homogeneous 4-vectors to 3-vectors can give you incorrect results. Give a concrete example exhibiting the failure and explain in detail why your example causes this failure. (You can demonstrate the problem in a lower dimension if you like, such as a triangle in 2D or even a line segment in 1D). Repeating the explanation from the book (or an explanation found online) is not an adequate answer. You must demonstrate that you understand the source of the problem.

Problem 5

Propose a texture mapping for the entire surface of the cone defined by $x^2 + y^2 \leq z^2$, $0 \leq z \leq 1$. The texture coordinates should lie in $[0, 1] \times [0, 1]$, and the entire cone (both curved and flat parts) should be covered. No two points on the cone should map to the same place in the texture image. In addition to providing the mapping, draw a square (representing the texture

¹You will probably need to research this.

image) and sketch the portion of it that is being used for the curved part and the flat part.
(You do not have to utilize the whole texture image.)