CMSC427 Fall 2017 **Due: Tuesday, Oct. 17 by class**

Hw 5 – Standard shading equations (plus one matrix) **Worth: 20 points**

1. Show that a square 3D orthonormal rotation matrix M has the inverse M^T, so $M^* M^T = I$.
Use the properties of the matrix that, if rewritten as three column vectors **c1**, **c2**, **c3**, we have **c1•c1** = 1, **c2•c2** = 1, **c3•c3** = 1, and we have **ci*cj** = 0 if $i \neq j$. These properties plus the basics of matrix multiplication are enough to complete the demonstration.

$$M = \begin{bmatrix} c1x & c2x & c3x \\ c1y & c2y & c3y \\ c1z & c2z & c3z \end{bmatrix} = [\boldsymbol{c1} \quad \boldsymbol{c2} \quad \boldsymbol{c3}]$$

2. Given the following scene:

Vertex at	(5,0,0)	with kd = 0.80, ks = 0.70, ka = 0.40
Normal	(0,1,0)	
Light at	(1,5,0)	with cl = 100, p = s = 2
Camera at	(10,4,1)	
Ambient light		with ca = 50

a) Compute the diffuse component cd. Assume for (a), and the rest of question 2, the light is a point light but not attenuated by distance – compute the L vector as in the slides, before the section on lights.

b) Compute the specular component by the Phong model (call this cp, on slides called c). As part of this show your work on computing the R reflection vector.

c) Compute the specular component by the Blinn model (call this cb).

d) Compare the results of the Phong and Blinn model. Are they close?

e) Compute the ambient component, call this ca.

3. With the scene above, recompute the diffuse component assuming

a) The light is a point source. Now assume the light is attenuated by distance.

b) The light is a spotlight with direction <3,-5,0> and theta max 30 degrees.

c) There is a directional light with direction <3,-5,0>.