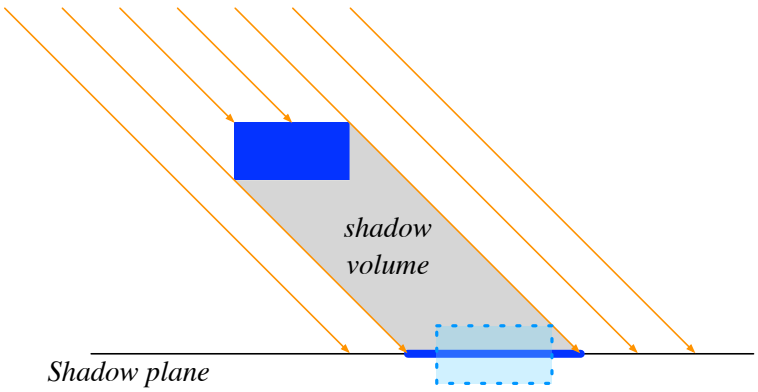
CMSC 23700 **Winter 2014**	**Introduction to Computer Graphics**	**Homework 3** **Due February 13**

1. The term Z-fighting is used to describe the situation when two primitives are mapped to the same Z-buffer value. Suppose you have an application with a near plan of 10 meters, a far plane of 100 kilometers (10^5 meters), and a minimum feature size of 1 meter. How many bits of Z-buffer do you need to avoid Z-fighting? What if the near plane is at 1 meter?

2. Assume that we are approximating the circle defined by $x^2 + y^2 - r^2 = 0$ and $z = d$ (in eye space) by a hexagon. If the focal length is e, what is the maximum error in the radius of the approximation in projection-space coordinates.

3. One easy to implement shadowing technique is to construct a transformation matrix that maps the shadow caster to a planer object on the shadow plane, as show in the following figure:



Let $\mathbf{l}$ be the direction of the directional light and let $\mathbf{P} = \langle \mathbf{n}, d \rangle$ be the definition of the shadow plane, where $|\mathbf{n}| = |\mathbf{l}| = 1$, d is the signed distance to the origin, and $\mathbf{n} \cdot \mathbf{l} < 0$.

Give the definition of a 4×4 matrix that maps objects to their shadows in the shadow plane. You may give your answer as a concatenation of matrices, but you should explain the reasoning behind your answer.

How would your answer change if the light source was a point light?