Coms 331 **The Framebuffer - Part 2** **Fall 2007**

Homework 38

Define the projection matrix

$$\mathbf{P} = \begin{pmatrix} \frac{2n}{r-l} & 0 & \frac{r+l}{r-l} & 0 \\ 0 & \frac{2n}{t-b} & \frac{t+b}{t-b} & 0 \\ 0 & 0 & -\frac{f+n}{f-n} & -\frac{2fn}{f-n} \\ 0 & 0 & -1 & 0 \end{pmatrix}.$$

1. Let $l = -4, r = 4, b = -3, t = 3, n = -1$ and $f = -1000$. Use $\mathbf{P}$ to find the normalized device coordinates for the points $(0, 0, -998)$ and $(0, 0, -999)$.

2. Assume that the depth buffer rounds its value to six significant decimal digits. What are the depths of the two points in the previous exercise? Are they distinguishable? Which one will be rendered?

3. It is tempting to let n be very small in order to avoid clipping the scene near the viewpoint. However, there is a price to pay. Let $l = -4, r = 4, b = -3, t = 3, n = -0.01$ and $f = -1000$. Use $\mathbf{P}$ to find the normalized device coordinates for the points $(0, 0, -998)$ and $(0, 0, -999)$.

4. What are the depths of the two points in the previous exercise? Are they distinguishable? Which one will be rendered?