Solution - Exercise [4]

Introduction to Computer Graphics - B-IT Master Course

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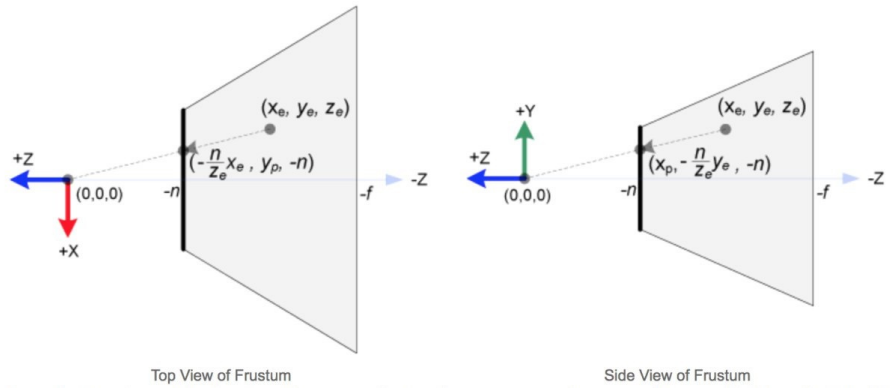
First Exercise

n - distance to the near clipping plane

f - distance to the far clipping plane

l, r, t, b - left, right, top, bottom coordinates of the near clipping plane

Second Exercise



Top View of Frustum Side View of Frustum

When we do projection from x, y, z to x, y plane we have to divide by $-z_e$ as $\frac{x_p}{x_e} = \frac{-n}{z_e} \Rightarrow x_p = -n \cdot \frac{x_e}{z_e}$

The same with y_p: $y_p = -n \cdot \frac{y_e}{z_e}$
As we have homogeneous coordinates, we just put -1 into the respective position in the projection matrix

Third Exercise

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

This transformations makes shearing with respect to x and y. We also multiply by n in order to get the proportions we lose during projections at the beginning of the operations.