Questão 2)

a) $p^* = {}_{\$}T'_{obj} \cdot p^*$ → sem escala

↳ global ↳ local

$$T'_{obj} = T\begin{pmatrix}1\\2\\0\end{pmatrix} \cdot \overbrace{R_z(45^\circ) \cdot R_y(-90^\circ)}^{R'}$$

$$\begin{bmatrix} 0 & -\sqrt{2}/2 & -\sqrt{2}/2 & 1 \\ 0 & \sqrt{2}/2 & -\sqrt{2}/2 & 2 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

→ Por conversão de sistema de coordenadas

$i' = (0, 0, 1)$

$$j' = (O' - O_c)_u = \left(\begin{pmatrix}1\\2\\0\end{pmatrix} - \begin{pmatrix}2\\1\\0\end{pmatrix}\right)_u = \begin{bmatrix}-1\\1\\0\end{bmatrix}_u = \frac{\begin{pmatrix}-1\\1\\0\end{pmatrix}}{\sqrt{2}} = \begin{pmatrix}-\sqrt{2}/2\\ \sqrt{2}/2\\ 0\end{pmatrix}$$

$$K' = i' \cdot j' = \begin{vmatrix} x & y & z \\ 0 & 0 & 1 \\ -\sqrt{2}/2 & \sqrt{2}/2 & 0 \end{vmatrix} = \begin{bmatrix}-\sqrt{2}/2 \\ -\sqrt{2}/2 \\ 0\end{bmatrix}$$

$${}_{\$}T'_{obj} = \begin{bmatrix} 0 & -\sqrt{2}/2 & -\sqrt{2}/2 & 1 \\ 0 & \sqrt{2}/2 & -\sqrt{2}/2 & 2 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

* Continuação da questão 2

b) $p^* = T_c \cdot {}_{\$}T'_{obj} \cdot p^{*'} \rightarrow (1,0,0)_{local}$

$p^* (1,2,1)$ global

olho = O_c = (2, 1, 0)
centro = O' = (1, 2, 0)
up = (0, 1, 0)
} Código OpenGL

O_c = olho = (2, 1, 0)

$$K_c = (\text{olho} - \text{centro})_u = \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}_u = \begin{pmatrix} \sqrt{2}/2 \\ -\sqrt{2}/2 \\ 0 \end{pmatrix}$$

$\sqrt{2}$

$$i_c = (up \times K_c)_u = \begin{vmatrix} x & y & z \\ 0 & 1 & 0 \\ 0 & -1 & 0 \end{vmatrix}_u = \begin{pmatrix} 0 \\ 0 \\ -1 \end{pmatrix}$$

$$j_c = (K_c \times i_c)_u = \begin{vmatrix} x & y & z \\ \sqrt{2}/2 & -\sqrt{2}/2 & 0 \\ 0 & 0 & -1 \end{vmatrix} = \begin{pmatrix} \sqrt{2}/2 \\ \sqrt{2}/2 \\ 0 \end{pmatrix}$$

$T_c = ?$

$$R^T \cdot (-O_c) = \begin{array}{c} i_c \\ j_c \\ K_c \end{array} \begin{vmatrix} 0 & 0 & -1 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 \\ \sqrt{2}/2 & -\sqrt{2}/2 & 0 \end{vmatrix} \cdot \begin{pmatrix} -2 \\ -1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ -3\sqrt{2}/2 \\ -\sqrt{2}/2 \end{pmatrix}$$

$$T_c = \begin{bmatrix} 0 & 0 & -1 & 0 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 & -3\sqrt{2}/2 \\ \sqrt{2}/2 & -\sqrt{2}/2 & 0 & \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

⇝ Continuação da questão 2

$p^{*'} = (1, 0, 0)$

- $p^{*} = \$\, T'_{obj} \cdot p^{*'} =$

$$\overset{\$\,T'_{obj}}{\begin{bmatrix} 0 & -\sqrt{2}/2 & -\sqrt{2}/2 & 1 \\ 0 & \sqrt{2}/2 & -\sqrt{2}/2 & 2 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}} \cdot \overset{p^{*'}\ \text{local}}{\begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}} = \overset{\text{global}}{\begin{bmatrix} 1 \\ 2 \\ 1 \\ 1 \end{bmatrix}}$$

$p_c^{*} = T_c \cdot p^{*} =$

$$\begin{bmatrix} 0 & 0 & -1 & 0 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 & -3\sqrt{2}/2 \\ \sqrt{2}/2 & -\sqrt{2}/2 & 0 & -\sqrt{2}/2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \overset{\text{global}}{\begin{bmatrix} 1 \\ 2 \\ 1 \\ 1 \end{bmatrix}} = \overset{\text{local da camera}}{\begin{bmatrix} -1 \\ 0 \\ \sqrt{2} \\ 1 \end{bmatrix}}$$

⇝ Código OpenGL

```
gluLookAt(2, 1, 0, 1, 2, 0, 0, 1, 0);
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