Graphische Datenverarbeitung WS17/18
Theorieübung 3

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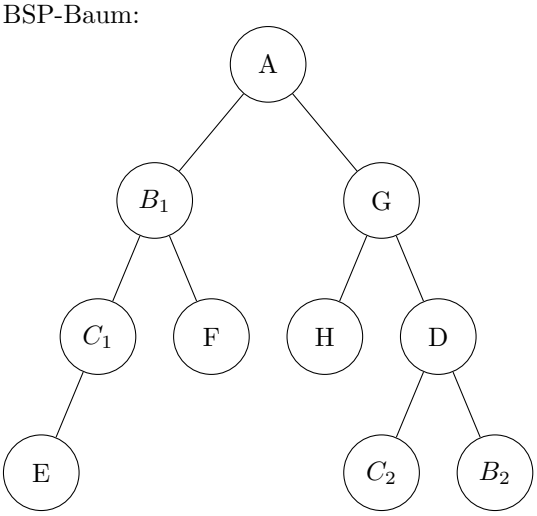
12. Dezember 2017

Aufgabe 1: Räumliche Datenstrukturen (2 Punkte)

a) (1 Punkt)

BSP-Baum:



b) (1 Punkt)

Zeichenreihenfolge (Zuerst → Zuletzt):
H, G, B_2, D, C_2, A, C_1, E, B_1, F

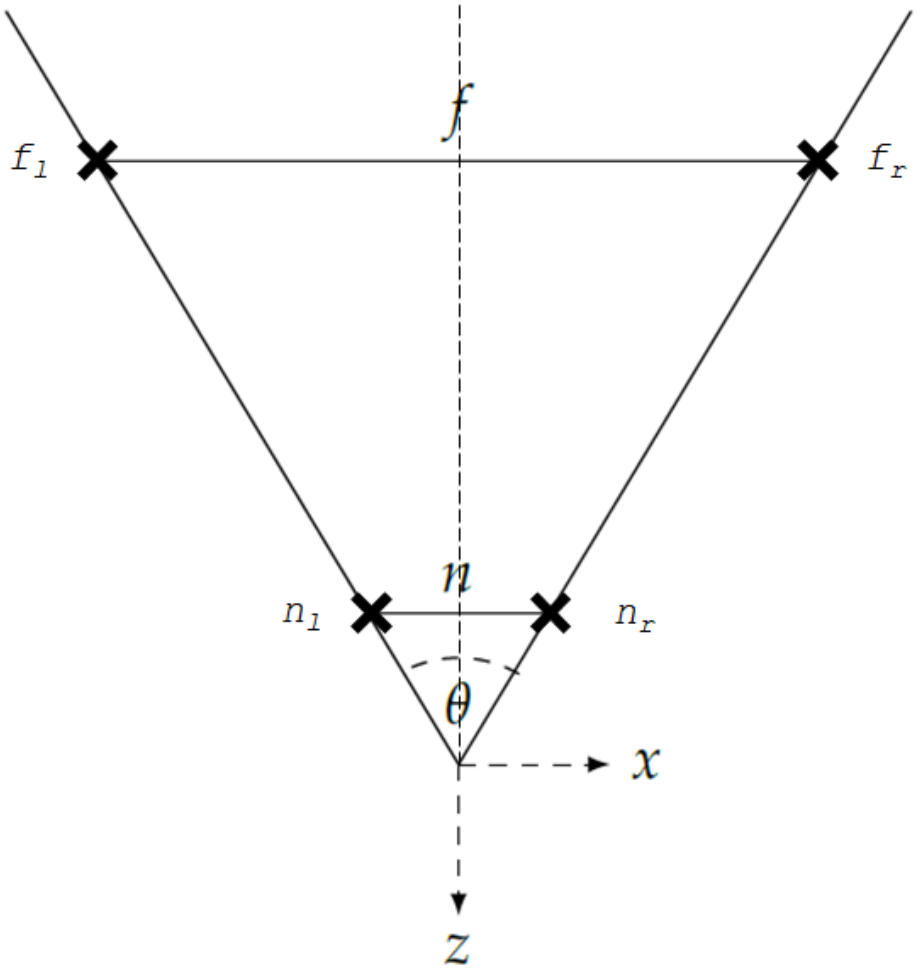
Aufgabe 2: Projektionen (5 Punkte)

a) a)

i i

$$f_l = \begin{pmatrix} tan(\frac{\theta}{2}) \cdot f \\ f \end{pmatrix}$$
$$f_r = \begin{pmatrix} -tan(\frac{\theta}{2}) \cdot f \\ f \end{pmatrix}$$
$$n_l = \begin{pmatrix} tan(\frac{\theta}{2}) \cdot n \\ n \end{pmatrix}$$
$$n_r = \begin{pmatrix} -tan(\frac{\theta}{2}) \cdot n \\ n \end{pmatrix}$$

ii ii



$$f_l = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1+\frac{-f}{-n} & -f \\ 0 & -\frac{1}{-n} & 0 \end{pmatrix} \cdot \begin{pmatrix} tan(\frac{\theta}{2}) \cdot f \\ f \\ 1 \end{pmatrix} = \begin{pmatrix} -\frac{-n}{f} \cdot tan(\frac{\theta}{2}) \cdot f \\ -\frac{-n}{f} \cdot (-f) - (-f-n) \\ 1 \end{pmatrix}$$
$$= \begin{pmatrix} n \cdot tan(\frac{\theta}{2}) \\ f \\ 1 \end{pmatrix}$$
$$f_r = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1+\frac{-f}{-n} & -f \\ 0 & -\frac{1}{-n} & 0 \end{pmatrix} \cdot \begin{pmatrix} -tan(\frac{\theta}{2}) \cdot f \\ f \\ 1 \end{pmatrix} = \begin{pmatrix} -\frac{-n}{f} \cdot (-tan(\frac{\theta}{2})) \cdot f \\ -\frac{-n}{f} \cdot (-f) - (-f-n) \\ 1 \end{pmatrix}$$
$$= \begin{pmatrix} -n \cdot tan(\frac{\theta}{2}) \\ f \\ 1 \end{pmatrix}$$
$$n_l = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1+\frac{-f}{-n} & -f \\ 0 & -\frac{1}{-n} & 0 \end{pmatrix} \cdot \begin{pmatrix} tan(\frac{\theta}{2}) \cdot n \\ n \\ 1 \end{pmatrix} = \begin{pmatrix} -\frac{-n}{n} \cdot tan(\frac{\theta}{2}) \cdot n \\ -\frac{-n}{n} \cdot (-f) - (-f-n) \\ 1 \end{pmatrix}$$
$$= \begin{pmatrix} n \cdot tan(\frac{\theta}{2}) \\ n \\ 1 \end{pmatrix}$$
$$n_r = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1+\frac{-f}{-n} & -f \\ 0 & -\frac{1}{-n} & 0 \end{pmatrix} \cdot \begin{pmatrix} -tan(\frac{\theta}{2}) \cdot n \\ n \\ 1 \end{pmatrix} = \begin{pmatrix} -\frac{-n}{n} \cdot (-tan(\frac{\theta}{2})) \cdot n \\ -\frac{-n}{n} \cdot (-f) - (-f-n) \\ 1 \end{pmatrix}$$
$$= \begin{pmatrix} -n \cdot tan(\frac{\theta}{2}) \\ n \\ 1 \end{pmatrix}$$

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$$r = n \cdot tan(\tfrac{\theta}{2}) \qquad l = -n \cdot tan(\tfrac{\theta}{2})$$
$$f_l' = P_0 \cdot f_l = \begin{pmatrix} \frac{2}{r-l} & 0 & \frac{r+l}{l-r} \\ 0 & \frac{2}{f-n} & \frac{-f-n}{f-n} \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} n \cdot tan(\frac{\theta}{2}) \\ f \\ 1 \end{pmatrix}$$
$$= \begin{pmatrix} \frac{1}{n \cdot tan(\frac{\theta}{2})} & 0 & 0 \\ 0 & \frac{2}{f-n} & \frac{-f-n}{f-n} \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} n \cdot tan(\frac{\theta}{2}) \\ f \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$
$$f_r' = P_0 \cdot f_r = \begin{pmatrix} \frac{1}{n \cdot tan(\frac{\theta}{2})} & 0 & 0 \\ 0 & \frac{2}{f-n} & \frac{-f-n}{f-n} \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} -n \cdot tan(\frac{\theta}{2}) \\ f \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ 1 \\ 1 \end{pmatrix}$$
$$n_l' = P_0 \cdot n_l = \begin{pmatrix} \frac{1}{n \cdot tan(\frac{\theta}{2})} & 0 & 0 \\ 0 & \frac{2}{f-n} & \frac{-f-n}{f-n} \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} n \cdot tan(\frac{\theta}{2}) \\ n \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$$
$$n_r' = P_0 \cdot n_r = \begin{pmatrix} \frac{1}{n \cdot tan(\frac{\theta}{2})} & 0 & 0 \\ 0 & \frac{2}{f-n} & \frac{-f-n}{f-n} \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} -n \cdot tan(\frac{\theta}{2}) \\ n \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ -1 \\ 1 \end{pmatrix}$$

b) b)

c) c)

d) d)

Aufgabe 3: Clipping (3 Punkt)