Assignment in Computer Graphics II

– Assignment 2 –

Computer Graphics and
Multimedia Systems Group
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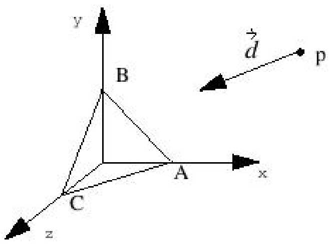
Assignment 1 [2 Points] Barycentric coordinates

Given is a triangle with the edges $A = (3,0,0)$, $B = (0,3,0)$ and $C = (0,0,3)$.

Ray 1: $P_1 = \begin{pmatrix} 2 \\ 3 \\ 2 \end{pmatrix} \quad \vec{d}_1 = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$

Ray 2: $P_2 = \begin{pmatrix} 3 \\ 6 \\ 6 \end{pmatrix} \quad \vec{d}_2 = \begin{pmatrix} -2 \\ -1 \\ -1 \end{pmatrix}$



Calculate for both rays the intersection with the triangular plane using barycentric coordinates.

- What are the parameters of the coefficients α and the barycentric coordinates (s_1, s_2) of the intersections?
- Are the intersections within the triangle (A, B, C)? (Reason necessary)

Assignment 2 [1 Point] Interpolation with squared polynomials

Given polynomials:

$$f_0(u) = 2u^2 - 3u + 1, \quad f_{\frac{1}{2}}(u) = -4u^2 + 4u, \quad f_1(u) = 2u^2 - u$$

and the defintion of a curve:

$$\mathbf{P}(u) = f_0(u)\mathbf{P}_0 + f_{\frac{1}{2}}(u)\mathbf{P}_{\frac{1}{2}} + f_1(u)\mathbf{P}_1$$

Show that $P(u)$ has following interpolation properties:

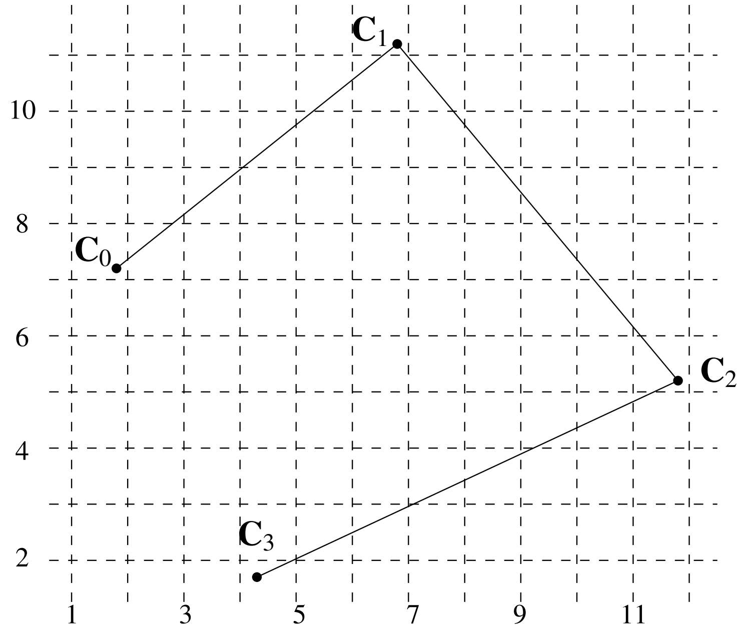
$$\mathbf{P}(0) = \mathbf{P}_0, \quad \mathbf{P}(\tfrac{1}{2}) = \mathbf{P}_{\frac{1}{2}}, \quad \mathbf{P}(1) = \mathbf{P}_1$$

Assignment 3 [2 Points] Example de Casteljau-Algorithm

Evaluate the cubic Bézier-curve with control points

$$\mathbf{C}_0 = \begin{pmatrix} 1.8 \\ 7.2 \end{pmatrix} \quad , \quad \mathbf{C}_1 = \begin{pmatrix} 6.8 \\ 11.2 \end{pmatrix} \quad , \quad \mathbf{C}_2 = \begin{pmatrix} 11.8 \\ 5.2 \end{pmatrix} \quad , \quad \mathbf{C}_3 = \begin{pmatrix} 4.3 \\ 1.7 \end{pmatrix}$$

graphically and mathematically with the **de Casteljau-Algorithm** for $u = 0.4$! Denote all the points!



Hand in: 28.04.2016, at beginning of the lecture or until 10:00 in the mailbox of the chair (next to room H-A 7107) or via e-mail.