# Assignment in Computer Graphics II

## – Assignment 3 –

**Computer Graphics and**
**Multimedia Systems Group**
David Bulczak, Christoph Schikora

**Assignment 1** [1 Point] A-Frame Construction

Given a cubic Bezier curve $C$ with control points

$$\mathbf{C}_0 = \begin{pmatrix}1\\1\end{pmatrix} \quad , \quad \mathbf{C}_1 = \begin{pmatrix}3\\4\end{pmatrix} \quad , \quad \mathbf{C}_2 = \begin{pmatrix}7\\5\end{pmatrix} \quad , \quad \mathbf{C}_3 = \begin{pmatrix}8\\2\end{pmatrix}.$$

Continue with another Bezier curve $D$ from control point $\mathbf{C}_3$ to control point $\mathbf{D}_3 = \begin{pmatrix}12\\1\end{pmatrix}$ so that the resulting curve is $C^2$ continuous.

1. Determine control points $\mathbf{D}_0$, $\mathbf{D}_1$, $\mathbf{D}_2$ for the new curve.
2. Specify a piecewise defined formula for the new curve $\mathbf{G}(v)$ with $v \in [0,1]$ that passes through $\mathbf{C}_0, \mathbf{C}_3$ and $\mathbf{D}_3$. Thus connect curves $C$ and $D$ in $v = \frac{1}{2}$.
3. Proof by calculation that the transition between $C$ and $D$ is $C^2$ continuous.

**Assignment 2** [1 Point] Catmull-Rom Approach

Calculate according to the Catmull-Rom approach, all control points for a cubic Bezier spline through the points $\mathbf{P}_0$, $\mathbf{P}_1$, $\mathbf{P}_2$ whose tangents at the beginning and end are set by additional points $\mathbf{P}_{-1}$ and $\mathbf{P}_3$.

$$\mathbf{P}_{-1} = \begin{pmatrix}0\\-3\end{pmatrix} \quad , \quad \mathbf{P}_0 = \begin{pmatrix}6\\0\end{pmatrix} \quad , \quad \mathbf{P}_1 = \begin{pmatrix}24\\3\end{pmatrix} \quad , \quad \mathbf{P}_2 = \begin{pmatrix}12\\6\end{pmatrix} \quad , \quad \mathbf{P}_3 = \begin{pmatrix}12\\9\end{pmatrix}.$$

**Submission: 30.10.2014, before /at the beginning of the exercise**