EXERCISES FOR INF3320 AND INF4320

BEZIER CURVES AND SURFACES

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1. Let $\mathbf{p}_0 = (-1, 1)$, $\mathbf{p}_1 = (1, 1)$, $\mathbf{p}_2 = (1, 0)$ be the control points of a quadratic Bezier curve $\mathbf{p}$.

   (a) Evaluate $\mathbf{p}$ at $t = \frac{1}{4}$ using the de Casteljau algorithm.

   (b) Evaluate $\mathbf{p}$ at $t = \frac{1}{4}$ using recursion on the basis functions.

2. Express a quadratic Bezier curve $\mathbf{p}(t) = \sum_{i=0}^{2} \mathbf{p}_i B_{0,2}(t)$ in monomial form, i.e., in the form $\mathbf{p}(t) = \mathbf{a}_0 + \mathbf{a}_1 t + \mathbf{a}_2 t^2$.

3. Express a quadratic polynomial $\mathbf{p}(t) = \mathbf{a}_0 + \mathbf{a}_1 t + \mathbf{a}_2 t^2$ in Bezier form, i.e., in the form $\mathbf{p}(t) = \sum_{i=0}^{2} \mathbf{p}_i B_{0,2}(t)$.

4. Show that the Bernstein polynomial $B_{i,d}$ attains its unique maximum at $t = i/d$.

5. Start from `ex7-6_bezier.cpp.template` and implement the function `deCasteljauEval` which applies the de Casteljau algorithm to the Bezier curve defined by `src_points` at the parameter value `t` (the degree of the curve is implicitly given by how many points there are).