

# Assignment 3 for INF4360, 2012

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To be completed by Tuesday 13 November. Solutions can be handed to me in the lecture or sent electronically to `michael.f@ifi.uio.no`.

1. Hermite interpolation: find the Bezier control points  $\mathbf{c}_i$  in the quintic representation

$$\mathbf{p}(t) = \sum_{j=0}^5 \mathbf{c}_j B_j^5(u),$$

where  $u = (t-a)/(b-a)$ , such that  $\mathbf{p}^{(i)}(a) = \mathbf{f}^{(i)}(a)$  and  $\mathbf{p}^{(i)}(b) = \mathbf{f}^{(i)}(b)$ ,  $i = 0, 1, 2$ .

2. Implement  $C^2$  cubic spline curve interpolation. Given points  $\mathbf{x}_i \in \mathbb{R}^2$ ,  $0 \leq i \leq n$ , choose some parameter values  $t_0 < t_1 < \dots < t_n$  and find the unique  $C^2$  cubic spline curve  $\mathbf{s} : [t_0, t_n] \rightarrow \mathbb{R}^2$  such that  $\mathbf{s}(t_i) = \mathbf{x}_i$ ,  $0 \leq i \leq n$ , and  $\mathbf{s}'(t_0) = \mathbf{s}'(t_n) = \mathbf{0}$ . Make plots of the curve  $\mathbf{s}$  for the three choices of parameterization

$$t_{i+1} - t_i = \|\mathbf{x}_{i+1} - \mathbf{x}_i\|^\mu,$$

with  $\mu = 0, 1/2, 1$ , and for the following two data sets. The first data set is  $\mathbf{x}_i = (x_i, y_i)$ , where

$$\begin{aligned}(x_0, \dots, x_9) &= (261, 261, 283, 287, 280, 281, 302, 319, 335, 277), \\(y_0, \dots, y_9) &= (703, 738, 718, 723, 735, 736, 731, 748, 737, 682).\end{aligned}$$

The second data set is  $\mathbf{x}_i = (\cos(s_i), \sin(s_i))$ , where

$$\begin{aligned}(s_0, s_1, \dots, s_{12}) &= \\(0, 0.24, 0.39, 0.78, 1.03, 1.18, 1.56, 1.81, 1.96, 2.34, 2.59, 2.74, 3.12).\end{aligned}$$

What effects of the three parameterizations do you observe?