CS557 W09

Homework #5

Due Thursday, 17 September 2009

1. The *weight ratio* of a rational Bézier curve is the largest divided by the smallest weight. For example, the weight ratio of a cubic Bézier curve with weights $8, 2, 3, 4$ is 4. If you want to plot a rational Bézier curve using a fixed number of evenly-spaced line segments, the resulting plot will generally look smoother if the curve is reparameterized so that weight ratio is minimized. For example, a rational cubic Bézier curve with weights $8, 2, 3, 1$ will not generally look as smooth as one with weights $2, 1, 3, 2$. Given a rational cubic Bézier curve with weights 1,4,12,27, reparameterize the curve so that the weight ratio is less than 2. (See Section 2.10.3)

2. Convert the following power-basis polynomial into Bernstein form:

$$2t^4 - 4t^3 + 6t^2 - 1$$

3. Convert to a power-basis polynomial the following Bernstein basis polynomial:

$$4B_0^4(t) + 2B_1^4(t) - B_2^4(t) + 3B_3^4(t) + B_4^4(t).$$

4. Convert the following power-basis polynomial into a degree five Bernstein polynomial:

$$10t^2 - 15t + 6$$

5. A rational parametric curve is given by the equations

$$x(t) = \frac{t^3 + 3t^2 - 9t + 2}{-3t^3 + 3t^2 + 1}, \quad y(t) = \frac{2t^3 + 6t^2 - 3t + 3}{-3t^3 + 3t^2 + 1}.$$

   Find the control points and weights for the equivalent rational Bézier curve.

Hand in this homework at the beginning of class on 17 September.