CS557 HW 16
Due Thursday, 5 November 2009

1. A cubic Bézier curve has control points

$$\mathbf{P}_0 = (0,0), \quad \mathbf{P}_1 = (2,3), \quad \mathbf{P}_2 = (4,5), \quad \mathbf{P}_3 = (6,8).$$

   Find a fat line that tightly bounds the control polygon. Specifically, find the equations of two lines, $L_1(x,y) = a_1x + b_1y + c_1$ and $L_2(x,y) = a_2x + b_2y + c_2$ that are each parallel to $\mathbf{P}_0$—$\mathbf{P}_3$ and for which each control point lies in the positive half space of each line. Positive half space means that $L_1(x,y), L_2(x,y) \geq 0$ for all four control points.

2. Given a second Bézier curve $\mathbf{Q}(s)$ with control points

$$\mathbf{Q}_0 = (0,8), \quad \mathbf{Q}_1 = (2,4), \quad \mathbf{Q}_2 = (4,0), \quad \mathbf{Q}_3 = (9,0),$$

   using one step in the Bézier clipping algorithm, find the values of s for which $\mathbf{Q}(s)$ does not intersect the curve in Problem 1.

3. Find the Cartesian coordinates of all points of intersection between the implicit curve

$$f(x,y) = x^2 - 2xy - 6y^2 + 4x + 3y = 0$$

   and the parametric curve

$$x = 1 + 6t - 7t^2, \qquad y = 1 + 4t - 5t^2.$$

   How many intersection points does Bezout's theorem predict?