CS 779
Fall 2002
Assignment 4
Due: Monday, Novemeber 18

1. (10 points) Given a two-space quadratic polynomial in Bézier form over the interval $[0, 1]$ (this specifies the control points; the domain of the curve is the entire real line) and its biaffine blossom f, is there a blossom value of f for every point in the range? If so, give a formula/algorithm for determining a range point's blossom arguments. If not, state which regions of the plane have blossom values and which do not, and give a formula/algorithm for the pre-image of every point in the valid region. I.e., given a point (x, y) in the plane, find u, v such that $f(u, v) = (x, y)$.

2. (20 pts) State and prove the blossoming principle for a degree n polynomial with domain of arbitary dimension d.

3. (20 points) Implement a tesselator and viewer for either tensor-product Bézier patches or for triangular Bézier patches (your choice). Use 3D UI controls similar to the CS 488/688 assignment 3 (the puppet). In particular, the left mouse button should operate a track ball, the middle mouse button should translate in a plane parallel to the screen, and the right mouse button should translate in the direction perpendicular to the screen.

   To draw your patch, do **not** use the OpenGL splines routines. Instead, tesselate your patch(es) into a set of triangles and draw them with the OpenGL triangle drawing routines.

   You should have three drawing modes:

   - Wireframe: draw the boundaries of the triangles but do not fill them.
   - Shaded: draw filled, shaded triangles.
   - Control net: draw both filled shaded triangles and the control net (both the control points and the connectivity).