Assignment 4: Curves and Surfaces

15-462 Graphics I
Spring 2002
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Out February 22
Due February 28 before lecture
50 points

- The work must be all your own.
- The assignment is due **before lecture** on Thursday, February 28.
- Be explicit, define your symbols, and explain your steps.
  This will make it a lot easier for us to assign partial credit.

1   Bezier Curves (20 pts)

1. Under which conditions do we have C^1 continuity for two joined Bezier curves? Write out the condition explicitly as a test on the control points $\mathbf{p}_0, \mathbf{p}_1, \mathbf{p}_2, \mathbf{p}_3$ and $\mathbf{q}_0, \mathbf{q}_1, \mathbf{q}_2, \mathbf{q}_3$ of the two curves.

2. Under which conditions do we have G^1 continuity for two joined Bezier curves? Again, write out the condition explicitly as in part 1.

3. It is possible for a single segment Bezier curve to intersect itself. Give four control points with all coordinates between 0 and 1 that yield a self-intersecting Bezier curve.

4. Include a printed image of a self-intersecting Bezier curve with your assignment. You can capture an X window with `xwd -out bezier.xwd` and convert it to JPEG format with `convert bezier.xwd bezier.jpg`.

2   Bezier Surfaces (15 pts)

1. Compute the normal vector of a Bezier surface patch at the four corners and at the center ($u = v = 0.5$) for a given set of control points.

2. Discuss how you would define the normals for a surface created from joined Bezier patches using Gouraud shading.

3   Cubic B-Splines (15 pts)

1. Analyze the effect of four collinear control points on a cubic B-spline.

2. Verify the C^2 continuity of the cubic spline at the join points.