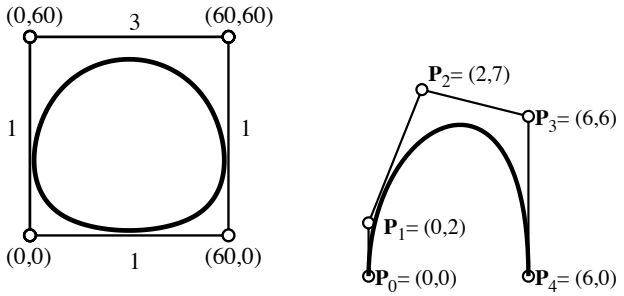
CS 557
Homework 9
Due Thursday, 1 October 2009

1. Find the polar form of $p(t) = 1 + 8t - 12t^2 + 4t^3$.

2. Using polar form, find the coefficients of the degree three Bernstein polynomial that is equivalent to $p(t) = 1 + 8t - 12t^2 + 4t^3$.



(a) Cubic B-Spline with Knot Intervals.

(b) Cubic B-Spline.

Figure 1: B-Spline Curves.

3. For the curve in Figure 1.a, split the knot interval whose value is 3 into two knot intervals whose values are 1 and 2. Report the Cartesian coordinates of the control points.

4. Find the Cartesian coordinates of the point on the cubic B-spline curve in Figure 1.a which the top-left control point at $(0, 60)$ maps to.

5. Express the hodograph of the curve in Figure 1.a as a degree 2 NURBS in knot interval form. Use that hodograph to compute the first derivative of the curve in Figure 1.a at the point which the top-left control point at $(0, 60)$ maps to.

6. Each edge on the control polygon in Figure 1.a maps to a Bézier curve. Find the Cartesian coordinates of the control points of the Bézier curve corresponding to the bottom edge of the control polygon in Figure 1.a.

7. The cubic B-spline curve in Figure 1.b has a knot vector $[0, 0, 0, 1, 3, 3, 3]$.
   a. Convert it to knot interval form by drawing the appropriate knot intervals on the control polygon (remember to sketch a "phantom" edge next to $\mathbf{P}_0$ and $\mathbf{P}_4$ to express the end-condition knot intervals).
   b.Find the Cartesian coordinates of $\mathbf{P}(1)$ using polar labels.
   c. Find the same point using knot intervals and explain your procedure.