CS 779, Winter 2020
Assignment 6 (The Mostly Programming Assignment)

1. (10 pts) Write a program to plot the B-spline basis functions for the following degree curves and knot vectors:
   (a) Degree 3, Knot Vector $(0, 1, 2, 4, 8, 16)$.
   (b) Degree 3, Knot Vector $(0, 1, 2, 3, 4, 4, 4, 5, 5, 6, 7, 8)$.
   (c) Degree 4, Knot Vector $(0, 1, 3, 3, 3, 4, 5, 7, 10)$.

   Your plots should look similar to the graphs on pages 141,142 of Farin's book, fifth edition. An even better example of what your plots should look like is in the course web page on the Assignments page.
2. (10 pts) Modify your B-spline editor to allow for direct manipulation of the B-spline curve.
3. (15 pts) Modify your B-spline curve editor to *rational* B-splines (NURBS). You may either use the rational de Boor algorithm to evaluate the curve, or you may evaluate the rational B-spline basis. You no longer need to display blossom values for the control points. Instead, you should display a control point name, such as P_0, followed by its weight. You should provide a method for interactively modifying the weight (eg, select a control point and drag the mouse, select a control point and move a slider, etc.). You should support at least quadratic and cubic NURBS curves.
4. (10 pts) Add a circle UI to your NURBS editor (eg, provide a button that when pressed, uses the next three mouse presses to define a circle). Use the next three mouse buttons to define a circle, and construct a quadratic NURBS curve for this circle. Your NURBS curve can have break points only at the selected points; you will probably need to use negative weights to achieve this.

Optional Questions (Extra credit?)

The following questions are optional. You might want to look at them, and think about them briefly. Do them and submit them if you want — I'll mark them if you do, and it won't hurt your grade. In fact, it might help your grade: if you do these question and miss points on the other questions on this assignment, I will use these to boost your score on this assignment up to 100%.

1. (5 pts) Modify your Bézier curve evaluation program to implement Neville's algorithm over a uniform knot vector. Your program should have the same functionality as Assignment 1, Question 3; your control points should be labeled P_0, P_1, etc.