DigiPen Institute of Technology, Bilbao

MAT300 Curves & Surfaces

Spring 2020. Homework 4: Deadline: 23-3-2020

In this assignment the algorithms are applied by hand calculations step by step. If you present any sort of screenshoot of a matrix created by a computer, or any code you will get a zero. Notice that the purpose of this assignment is to have something to test with your code.

1. (80%) Let $P_0 = (1, -1)$, $P_1 = (2, 3)$ and $P_2 = (0, 4)$ be the control points of a Bezier curve γ.

   - (20%) For $t_0 = 0$, $t_1 = \frac{1}{4}$, $t_2 = \frac{1}{2}$, $t_3 = \frac{3}{4}$ and $t_4 = 1$ apply the De Casteljau algorithm (numerically) to obtain the evaluation of the curve γ at the nodes.

   - (20%) Use the previous numerical results to draw the evaluation of the curve at every node doing the recursively linear interpolation (graphically). You have to plot the shells for each node in a separate graph where you identify numerically each intermediate control point, giving the corresponding label, and the evaluation of the curve in the plots. Then, you have to combine all the plots in the same graph using a different color for each node. You can do the plots by hand, use octave or any other program for that purpose. Revise the grading policy for graphs in the syllabus.

   - (20%) Apply three iterations of the midpoint subdivision algorithm (numerically), showing how many curves and points of γ do you get after each iteration, and what are the control points for the curves in the following iteration.

   - (20%) Use the previous numerical results to draw the evaluation of the curve after each iteration. Construct a plot for each iteration showing the control points of each curve (using different colors) and the obtained curve γ. You can do the plots by hand, use octave or any other program for that purpose. Revise the grading policy for graphs in the syllabus.

2. (20%) Find the quadratic Bezier curve that starts at $P_0 = (0, 0)$, goes through $Q = (1, 1)$ at $t = \frac{3}{4}$ and ends at $P_2 = (2, 4)$. Give the expression of the Bezier curve as linear combination of Bernstein polynomials, providing the corresponding interval.