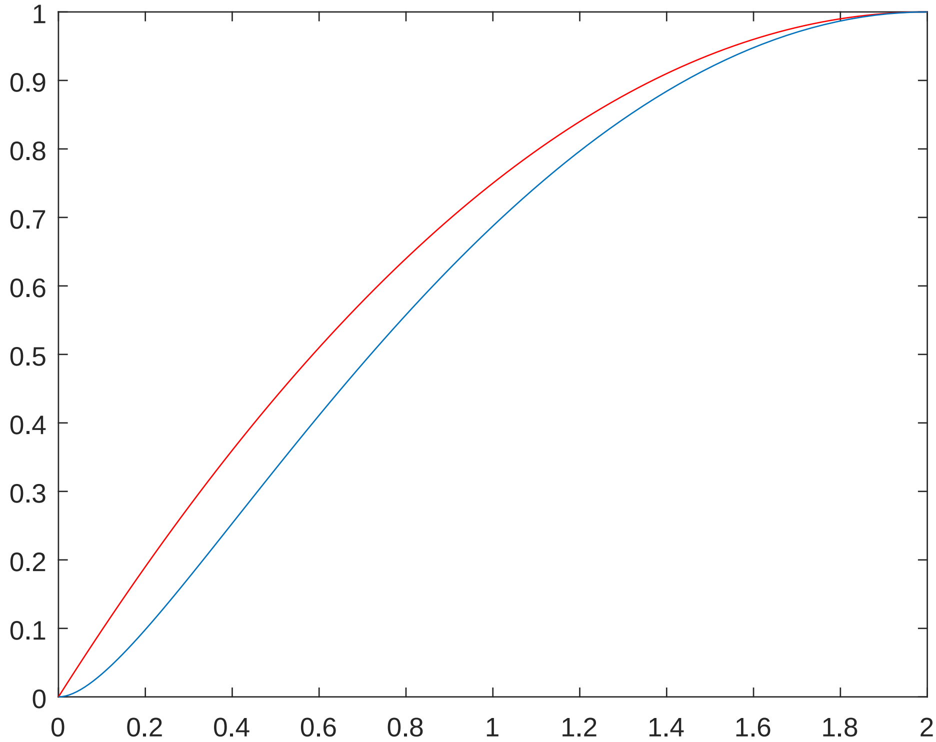
FMNN35/NUMN15
Numerical Methods for Computer Graphics
Numerisk Analys, Matematikcentrum

Homework 2

To be uploaded no later than September 18.

TASKS

(1) Construct a code to evaluate the Bernstein polynomials of arbitrary degree n at a given point $t = t_0$. Plot the Bernstein polynomials of degree 1 to 4 for $t \in [0, 1]$. Be prepared to identify their main properties.
(2) Use the previous result to construct a code that renders a Bézier curve given its control points, the parameter domain, and the number of plotting points required. Compare this implementation with de Casteljau's algorithm. Try it out for the same curve from Homework 1, Task 4.
(3) Implement subdivision and use your code to subdivide the Bézier curve with control points (-1,0), (0,1), (1,-2) and (2,0) and parameter domain $[0, 1]$, at $t = 0.4$. Give the control points of the resulting curves and plot them, showing the control polygons.
(4) Construct an algorithm that finds the intersections of a planar Bézier curve and a straight line. Try it out for the curve with control points (0,0), (9,-4), (7,5), and (2,-4); and the line passing through (4,5) and (6,-4).
(5) Consider the Bézier curve with control points (-1,0), (0,1), (1,-2) and (2,0) and parameter domain $[0, 1]$. Construct a composite Bézier curve by adding a Bézier curve of degree one at (2,0) so that the curve is C^1.
(6) The plot below shows a quadratic Bézier curve (top) with control points (0,0), (1,1) and (2,1). In order to modify this curve as shown (bottom curve), a degree elevation much be performed (why?). After doing this, try to reconstruct the bottom curve.


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2