Faculty of Mathematics and Computer Science
Babeş-Bolyai University, Cluj-Napoca
Numerical Analysis
MIE - semester IV

Laboratory 5

Deadline: 8 – 12 April 2024

Cubic spline interpolation

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1. Let us consider $f : [0, 2\pi] \to \mathbb{R}$ defined by $f(x) = \cos(x)$ and the nodes $\{0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi\}$.
   - Compute the value of the function, the valuea of the cubic **natural** spline and the valuea of cubic **clamped** spline function at $x = \frac{\pi}{4}$;
   - Plot (in the same figure) the graphs of f, the cubic natural spline and the cubic clamped spline functions.

   Hint: use the MatLab function *spline*

2. Using the MatLab function *ginput* construct a set with 5 arbitrary points in $\mathbb{R}^2$. Plot the points and the graph of cubic natural spline function that passes through the points.

3. Let us consider the following table (that contains some data regarding a moving car).

Time	0	3	5	8	13
Distance	0	225	383	623	993
Speed	75	77	80	74	72

   - Use a clamped cubic spline to predict the position of the car and its speed when the time is $t = 10$.

4. Let us consider the function $f(x) = \sin(2x)$ and 9 nodes between 0 and 2π. Consider also the linear polynomial spline

$$p_i(x) = f(x_i) + \frac{f(x_{i+1}) - f(x_i)}{x_{i+1} - x_i}(x - x_i)$$

   on each interval $[x_i, x_{i+1}]$. Plot (in the same figure) the graph of the function and the corresponding linear spline function.

Remark: 1 (1p), 2-4 (0.5p)