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

Laboratory 2

Deadline: 18 – 22 March 2024

Lagrange interpolation

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1. The table below contains the population of Romania from 1960 to 2020:

1960	1970	1980	1990	2000	2010	2020
18458008	19922618	22125224	22836234	21919876	20335211	19442038

   - Using the barycentric form of the Lagrange interpolation polynomial, approximate the population in 1974, 2005 and 2035. Compare the result from 1974 and 2005 with the one provided by `worldmeters.info` (1974 – 20889661 and 2005 – 21092264).
   - Plot the data on a graph with axis *year*, respectively *population*.

2. Approximate $\sqrt{153}$ with Lagrange interpolation (barycentric form), using known values for three given nodes.

3. Let $f : [0, 20] \to \mathbb{R}$ be given by $f(x) = \dfrac{2 + \sin(3\pi x)}{1 + x^2}$.
   - Plot the graphic of the function f on the interval $[0, 20]$;
   - Plot the Lagrange interpolation polynomial that interpolates the function f at 24 equally spaced points in the interval $[0, 20]$.

4. Let $f : [1, 14] \to \mathbb{R}$ be a function such that $f(n) = \dfrac{3\tan(n^2)}{n^2 + 2}$ for every $n \in \mathbb{N} \cap [1, 14]$.
   - Plot the graphic of the function f on the interval $[1, 14]$;
   - Plot the Lagrange interpolation polynomial that interpolates the function f on the interval $[1, 14]$;
   - Approximate $f(2.5)$ and $f(8.75)$.

5. Plot (in the same figure) the function $f(x) = \log(x + 2)$ and the Lagrange interpolation polynomial that interpolates f on 13 equispaced points in the interval $[-1, 1]$

Remark: 5 problems × 0.5p = 2.5p