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

Laboratory 6

Deadline: 15 – 19 April 2024

Least square approximation

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1. Let us consider the following table

Time	9	10	11	12	13	14	15
Temperature	12	10	8	11	15	17	13

   - Find the best linear least squares function $f(x) = ax + b$ that approximate the table (find a and b based on the formulas from Lecture 6).
   - Use your result to predict the temperature at $16:00$.
   - Find the minimum value $E(a, b)$ for the coefficients a and b obtained above (see the formula for $E(a, b)$ in Lecture 6).
   - In the same figure, plot the points (time, temperature) and the least squares function.

2. Let us consider the following table related to the concentration of the oxygen (percentage) as a function of altitude (in meters).

Altitude (m)	0	500	1000	2500	5000	8500
Location	Sea level	Cluj-Napoca	Chamonix	Aspen	Mont Blanc	Everest
Oxygen	20.9	19.6	18.4	15.3	11.2	7.2

   - Obtain two least square approximations for the given data (using *polyfit*) for 2 different degrees of polynomials. Find the concentration of the oxygen at $753m$, respectively at $6000m$.
   - Compute the approximation error knowing that at $6000m$ (Kilimanjaro) the concentration of oxygen is 9.9
   - Plot the interpolation points and the interpolation polynomials from the previous point (in the same figure).

3. Consider 10 random points in the plane $[0, 5] \times [0, 4]$ using MatLab function *ginput*. Plot the points and the least square polynomial of $2nd$ degree that best fits these points.

Remark: 1-2 (1p), 3 (0.5p)