Assignment 9

➽ **Read the assignment carefully! Remember that the first line of a script must be the call to the script preamble.**

A. Mandatory

Write a MATLAB script with the name `Assignment09A_IDxx.m`[1] that computes a numerical solution $y(x)$ of the following boundary value problem in [1,10]:

$$2x^4y''' + x^3y'' + 4x^2y' + 3xy = 0, \quad y(1) = 0,\ y(10) = 2,\ y'(10) = 1.$$

Plot the solution $y(x)$ and its first three derivatives superimposed in the same figure. Plot also the left-hand side of the differential equation substituting the solution and its derivatives and display its maximal absolute value in the command window. *(4 pt)*

➽ Use a grid of about 200 points in the interval I and a second-order polynomial in x as the initial guess of $y(x)$. You have to provide a guess for $y(t)$, $y'(t)$ and $y''(t)$!

B. Mandatory

Write a MATLAB script with the name `Assignment09B_IDxx.m`[1] that solves the following problem.

Load the matrix `X` from the file `pardata.mat`. The rows of `X` are the coordinates of points in the plane. Fit parabolas of the form $y = ax^2 + bx + c$ to the points by minimizing three objective functions:

(1) the sum of the squared (vertical) distances of the points to the parabola;
(2) the sum of the absolute (vertical) distances of the points to the parabola;
(3) the median of the squared (vertical) distances of the points to the parabola.

Find a suitable starting point for (1) and use `fminsearch` for the minimization. In (2) and (3), use *the result of the previous fit* as the starting point for `fminsearch`. Create a figure showing the points and the three fitted parabolas. Display the coefficients a, b, c and the values of the objective functions at the minimum in the command window. Repeat the entire sequence with minimizer `fminunc` and show the results in a second figure. *(4 pt)*

➽ Avoid code duplication by looping over the minimizers and the objective functions. Define static objects outside the loops.

➽ **Make sure that the relevant results and *only* those are shown in the output to the command window. Submit the script(s) until 5pm on June 9, 2021. Don't forget to put your partner in cc! Any violation of the naming convention will lead to the rejection of the submission.**

[1] `xx` is your (group's) ID number