

AM 147: Computational Methods and Applications: Winter 2021

Homework #5

Instructor: Abhishek Halder

Due: February 09, 2021

NOTE: Please submit your Homework as a single zip file named `YourlastnameYourfirstnameHW5.zip` via CANVAS. For example, `HalderAbhishekHW5.zip`. Please strictly follow the capital and small letters in the filename of the zip file you submit. You may not receive full credit if you do not follow the file-naming conventions. Your zip file should contain all .m files (MATLAB scripts) for the questions below.

Your zip file must be uploaded to CANVAS by 11:59 PM Pacific Time on the due date. The uploads in CANVAS are time-stamped, so please don't wait till last moment. Late homework will not be accepted.

Problem 1

Polynomial interpolation

(25 points)

Download the starter code `HW5p1.m` from CANVAS Files section folder "HW Problems" to your computer, and rename it as `YourlastnameYourfirstnameHW5p1.m`. This homework problem only requires you to complete two lines of this starter code as follows.

For each $n = 5, 6, 7$, the starter code generates n uniformly spaced data points in the interval $[-1, 1]$ and plots them as different colored circular markers (red for $n = 5$, green for $n = 6$, and blue for $n = 7$). Watch out for overlapping markers. For each n , you need to compute and plot an interpolating polynomial in the corresponding colored lineplot. To do so, uncomment and complete the lines 20 and 21 in the starter code. Then uncomment lines 23, 25, 27.

Other than completing the lines 20-21, and uncommenting lines 23, 25, 27, you are NOT allowed to change or add anything else in the starter code. You should be able to verify the correctness of your lines 20-21 by examining the plot that the completed code generates (and reviewing the concepts learnt in Lec. 9).

Problem 2

Finding a bivariate quadratic function

(25 points)

Let $\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$ be a vector of size 2×1 . Write a MATLAB code `YourlastnameYourfirstnameHW5p2.m` that finds a bivariate quadratic function

$$f(x_1, x_2) = \mathbf{x}^\top \mathbf{P} \mathbf{x} + \mathbf{q}^\top \mathbf{x} + r,$$

where \mathbf{P} is a 2×2 symmetric matrix, \mathbf{q} is a 2×1 vector, and r is a scalar, such that the function f satisfies the following conditions

$$f(0, 1) = 6, \quad f(1, 0) = 6, \quad f(1, 1) = 3, \quad f(-1, -1) = 7, \quad f(1, 2) = 2, \quad f(2, 1) = 6.$$

In other words, your code should output the matrix \mathbf{P} , the vector \mathbf{q} , and the scalar r .