

ESO 208A: Computational Methods in Engineering

Programming Assignment 3: *Least Squares and Interpolation*

Input: Read a set of data points $\{x_k, y_k\}; k = 0, 1, 2, \dots, n$ from an *input file*. The input file should contain the data set in two columns separated by 'tab' or 'comma'.

Write a computer program with the following options sequence:

Asks the user, "What do you want to do?"

- A. Fit a least square polynomial
 - a. If chosen, asks the user to specify the order of the polynomial (an integer $< n$).
 - b. Asks the user to choose whether the intercept should be zero (YES or NO)
 - c. Output is sent to a file and consists of the equation of the polynomial; a plot of the data (scatter) and the fitted polynomial; and the r^2 value.
- B. Fit a Lagrange Interpolation Polynomial
 - a. Output is sent to a file and consists of the equation of the polynomial and a plot showing the data (scatter) and the fitted polynomial
- C. Fit Cubic splines:
 - a. Gives the options to choose:
 - i. Natural Spline
 - ii. Not-a-knot
 - iii. Periodic
 - iv. Clamped Spline: if chosen, ask for two first derivative values at two end points.
 - b. Output is sent to a file and consists of the equation of the polynomial in each interval (coefficients in a tabular form); values of the first derivative and the 2nd derivative at each node; a plot showing the data (scatter) and the fitted polynomials

Test Problems: Use the data in Problems 6, 8, 10 and 11 of Problem Set 5.

Due date: Sunday, October 28, 2018, 11:59 pm

Make a single zip folder with all your program file(s) name it roll_number.zip (e.g., If your roll no. is 123456, the folder name should be 'P3_123456.zip'). The folder should include -

- (i) All the computer program file(s), input file(s) and output file(s)
- (ii) A PDF file of the plots and the solution of the test cases given in this assignment.

Send the zip file by e-mail to: eso208.sec*@gmail.com, where * is section number 1-10.
Example: for section O5, it is eso208.sec5@gmail.com; for section O10, it is eso208.sec10@gmail.com