ESO208A: Computer Assignment-4

Marks: 100 Due Date: Friday, November 5, 2021

Write a computer program for fitting a spline. The program should have the following features:

Input: The program should read - (i) input data points (x_i, y_i) $i = 1, 2, \ldots, N$ from a text file, (ii) the points x_j^* $j = 1, 2, \ldots, M$ where the value of y_j^* has to be estimated and (iii) value of slopes at the beginning and end nodes [only for clamped cubic spline].

Options: The user should have the option of selecting one or more of the following methods–

a. Linear spline
b. Quadratic spline
c. Natural cubic spline
d. Not-a-knot cubic spline
e. Periodic cubic spline
f. Clamped cubic spine

Output: The output from the program should be a

(a) text file containing the values of y_j^* ;

(b) figure showing the data points and the fitted spline.

Submission

Make a single zip folder with all your program file(s) name it roll number_CA3.zip (e.g., If your roll number is 123456, the folder name should be '123456_CA3.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.

Upload the zip file on mooKIT. In case of any difficulties with mooKIT upload, you may email the solution to eso208.sec*@gmail.com, where * is section number 1-10. Example: for section J5, it is eso208.sec5@gmail.com; for section J10, it is eso208.sec10@gmail.com. The subject line of the email should be same as your folder name.

Sample input file

input x and y
-1.000 0.0385
-0.500 0.1379
0.000 1.0000
0.500 0.1379
1.000 0.0385

points where function has to be evaluated (x*)
-0.8000
-0.2000
0.2000
0.8000

slope at the first (s0) and the last node (sn)
-1.0000 1.5000

Sample output files

Interpolated values y* at give x*

Linear spline
-0.800 0.0782
-0.200 0.6552
0.200 0.6552
0.800 0.0782

Quadratic spline
-0.800 0.0782
-0.200 0.4721
0.200 1.2520
0.800 -0.7016

Natural spline
-0.800 -0.0363
-0.200 0.7716
0.200 0.7716
0.800 -0.0363

Not-a-knot spline

-0.800 -0.2520
-0.200 0.8024
0.200 0.8024
0.800 -0.2520

Periodic spline
-0.800 0.0042
-0.200 0.7658
0.200 0.7658
0.800 0.0042

Clamped spline
-0.800 -0.0793
-0.200 0.7748
0.200 0.7868
0.800 -0.1222

Sample Figure