ESO208A: Computer Assignment-4

Marks: 100 Due Date: Friday, October 21, 2016

PART – I (30)

Write a computer program for polynomial least-squares fitting.

Input: The program should read data points $(x_i, y_i)\ i = 1, 2, \ldots, N$ from a text file.

Options: The user should have an option of selecting the degree of polynomial.

Output: The output from the program should be a

(a) text file containing the coefficients of polynomials and coefficient of determination;

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

PART – II (70)

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

Due date: Friday, 21 October by 5:00 pm

Submit a single zip folder in the Brihaspati server under Assignment-4. The name of the zip-folder should be “your roll-number_CA4” (e.g. If your roll no. is 99999, the folder name should be '99999_CA4.zip'). The folder should include -

(i) All the computer program file(s)
(ii) Input file for the test data and output file for the test data generated by your program(s)

Test Data: Part I:

Sample input file

0.051	0.287
0.073	0.983
0.089	0.857
0.798	9.997
0.943	18.345
0.684	6.233
0.132	0.994
0.723	6.805
0.110	0.845
0.117	1.578
0.641	4.122
0.329	1.633
0.654	5.462
0.749	7.621
0.583	4.249
0.740	7.610
0.235	0.935
0.735	7.564
0.971	20.224
0.867	12.940

Sample output files

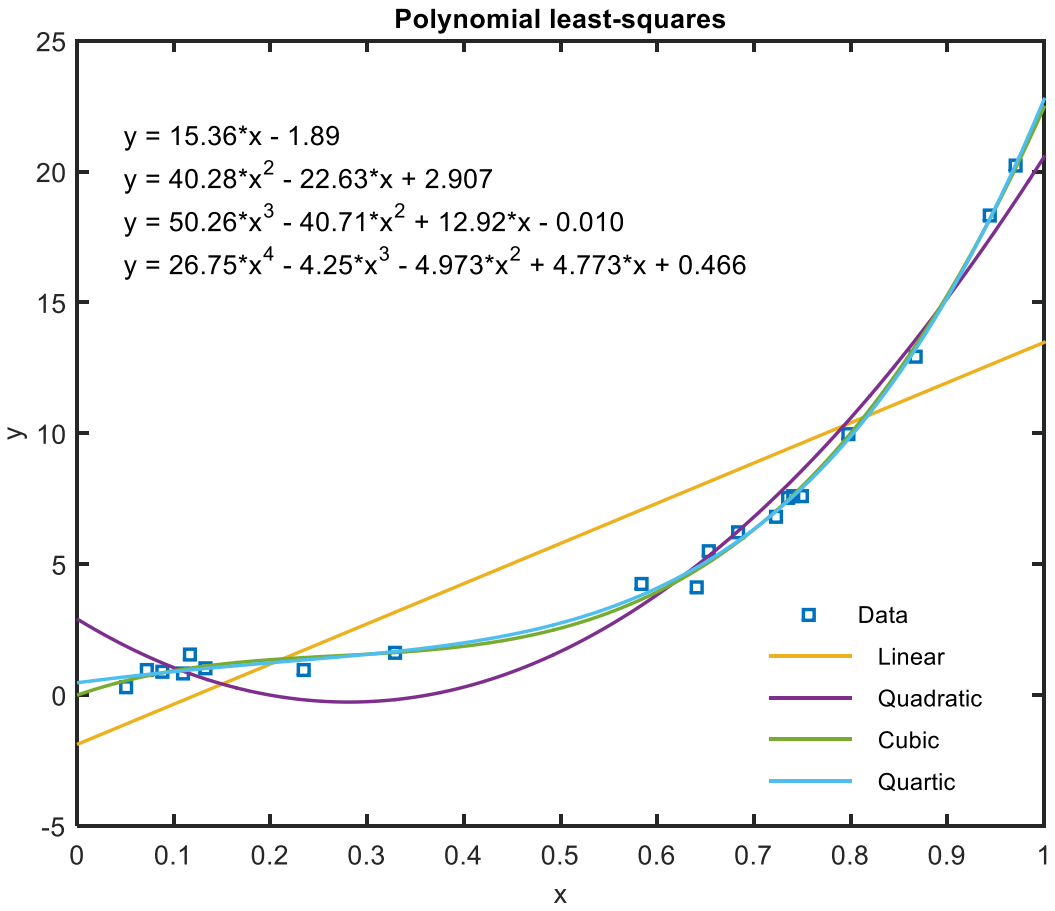
Linear : coefficients -1.890 15.364
: R-sq = 0.7572

Quadratic : coefficients 2.907 -22.626 40.279
: R-sq = 0.9765

Cubic : coefficients -0.010 12.917 -40.710 50.262
: R-sq = 0.9965

Quartic : coefficients 0.466 4.773 -4.973 -4.250 26.747
: R-sq = 0.9968

Sample Figure



Part II:

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