

Homework Set 5

Each problem is worth 10 points.

Due date: Thursday 15 November

1. Apply linear least squares with the model $f(x; A, B, C, D) = Ax^3 + Bx^2 + Cx + D$ to the data set $(0, 4), (1, -1), (2, 6), (3, 1), (4, -4), (5, -9)$. You may use either the MATLAB program `lspoly` on pages 274-5 or build and solve the system directly in MATLAB. Report the values of A, B, C and D clearly, and produce a plot showing the data and the cubic fitting function. Recall that if you use `lspoly`, do not flip the C vector (ie, remove the line `C=flipud(C)`). The output is then consistent with our horner algorithm.
2. Apply nonlinear least squares to fit the data set $(0, 0.1), (1, 1), (2, 1.5), (3, 0.8), (4, 0.3), (5, 0.25)$. Decide which functional form matches the data reasonably well (see page 268 for some options that you might or might not use). Pick a form that has 2 or 3 parameters. See Example 5.5 on page 266 and class notes to see how to build the function S to be minimized, and use `fminsearch` to find the parameter values. Report those values clearly, and produce a plot showing the data and your fitting function.
3. Apply a clamped cubic spline to the data set in problem 1. Produce a plot showing the data and the spline on the intervals $[0, 5]$ and $[-1, 10]$. Use any reasonable estimates for the endpoint derivatives y'_0 and y'_n . The plot on $[0, 5]$ shows the fine details, and the plot on $[-1, 10]$ shows that the spline is cubic (and hence not very satisfying) outside the range of the data. You may wish to try several different sets of endpoint derivatives and compare the results on the 2 intervals.