MATH 3341 — Fall 2020

Lab 08: MATLAB Interpolation Routines & Their Derivatives

Download `Math.3341.Lab.08.zip`, unzip it and replace the files under `H:\Math.3341\Math.3341.Lab.08`. Change the current working directory by typing `cd H:\Math.3341\Math.3341.Lab.08` in the Command Window, and type `edit lab_08_script` in the Command Window to edit `lab_08_script.m`.

1 Polynomial Interpolation Routines

(a) Fit `xdata` and `ydata` by an `n`th order polynomial using `polyfit`. Then use `polyval` to evaluate the polynomial at `x`.

(b) Evaluate the cubic spline of `xdata` and `ydata` at `x` using `spline` command.

(c) Now use the `pchip` command to find the values of the piecewise cubic Hermite interpolating polynomial at `x`.

(d) Make a copy of your implementation of Lagrange interpolation for Homework 5. Use your function to find the function values of the Lagrange interpolation polynomial at `x`.

(e) Uncomment "3 Plot interpolation polynomials" section, which will create the figure comparing each of the polynomial interpolations. If you cannot get your Lagrange interpolation polynomial to work, comment in the relevant lines of code that plot that figure. Expected plot is shown in Figure 1.

2 Derivatives of Interpolation Polynomials

(a) Use `polyder` to calculate the coefficients of the first derivative of the interpolation polynomial given by `polyfit` that you constructed, and evaluate it at `x` using `polyval`.

(b) Repeat (a) to find the second derivative of the interpoation polynomial.

(c) Fit `xdata` and `ydata` using cubic spline and store the structure of the cubic spline interpolation polynomial to `cs_struct`.

(d) Using slicing technique to extract the columns of `cs_struc.coefs` which correspond to each coefficient of the piecewise cubic spline, and store each of these columns in `b`, `c`, `d`, respectively.

(e) Use these coefficients along with `xdata`, `x` to evaluate the first and second derivatives of the spline using `cubic_spline_der.m`. Use `help cubic_spline_der` to get details of the function.

(f) Uncomment "4 Plot derivatives" section to generate corresponding plots. Expected plot is shown in Figure 2.

At the end of the day, upload `lab_08_script.m`, `lab_08_figure_01.pdf` and `lab_08_figure_02.pdf` to Overleaf (make sure you change the caption for the figures), then recompile, and submit the generated .pdf file on WyoCourses.

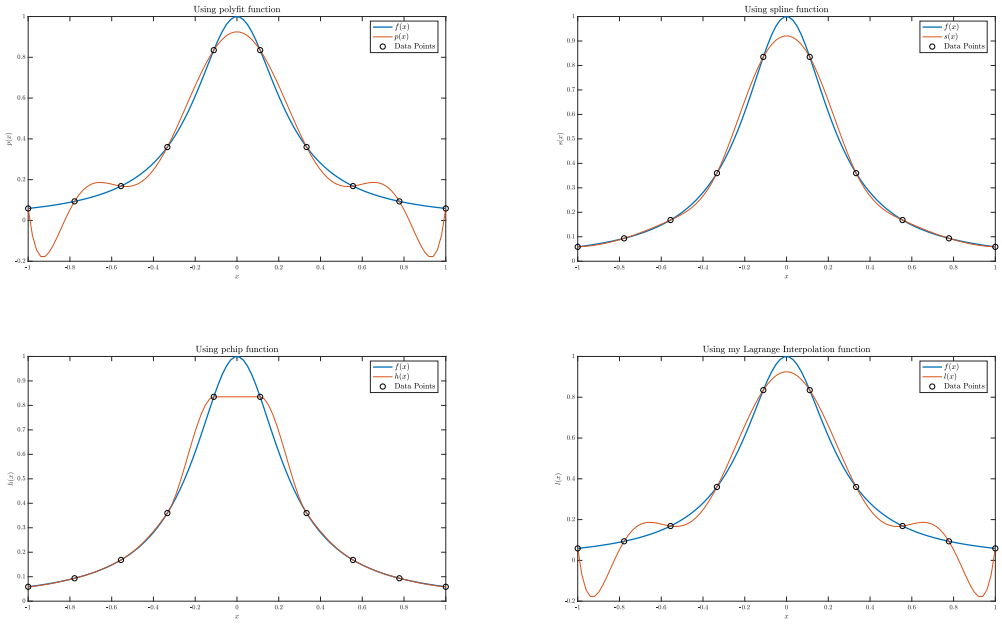

Figure 1: Polynomial Interpolation using different routines

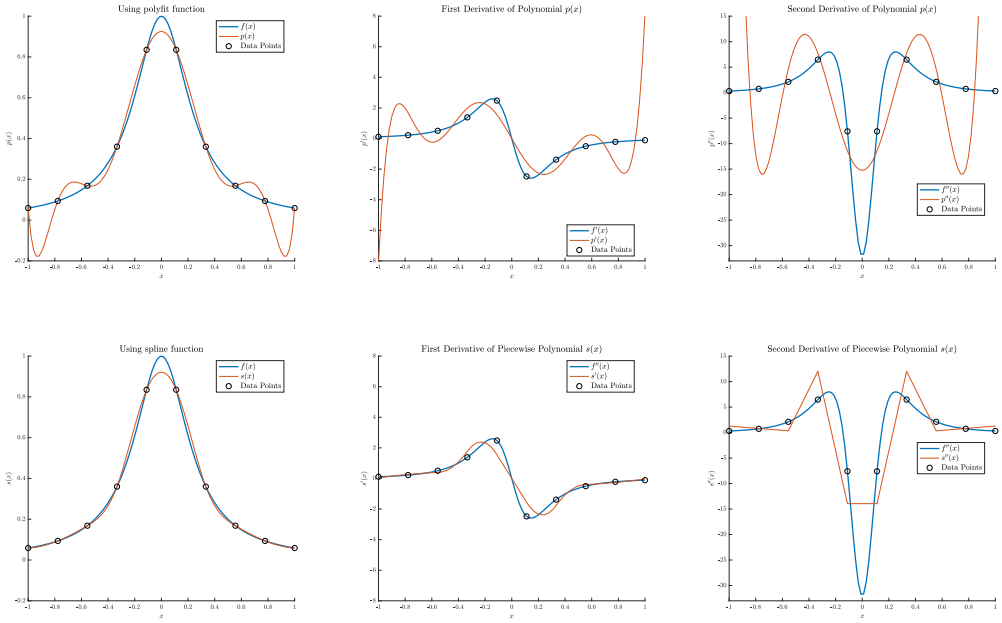

Figure 2: Derivatives of Interpolation Polynomials