Homework 1

September 27, 2016

The homework discusses interpolating the function

$$f(x) = \frac{e^{3x}\sin(20x^2)}{1+2x^2} \qquad 1 < x < 2 \tag{1}$$

based on its values on a grid of points. We sample the function at equally spaced points x_i, $i = 1, ..., N$ for N=10,20,30. We choose a known function so we can compare the exact value to various interpolation schemes.

- Plot the function and note its features.

- Using the values on the increasingly fine grids, and spline interpolation, observe the quality of interpolation.

- Repeat the exercise using polynomial interpolation with the same set of grids.

- Finally, use polynomial interpolation with a grid of Chebyshev points $x_i = 2 + \frac{1}{2}\cos(\frac{(2i-1)\pi}{2N})$, $i = 1, ..., N$ for N=10,20,30.

You may use spline interpolation as implemented by Matlab, and the code provided on the website for polynomial (barycentric) interpolation.

In each case, provide plots of the comparison between the interpolating functions and the exact results and comment on the quality of interpolation.

You might be curious to repeat this for other intervals (e.g. $3 < x < 4$), where results may be more dramatic.