MATH 340 - Lab Instructor: Valeria Barra

LAB 6 Assignment

DUE Tuesday 03-01-2016

Lagrange's Interpolant Polynomial using Chebyshev nodes

Last week we saw how to construct a Lagrange interpolating polynomial, given a set of equally spaced nodes x_i on an interval $[a, b]$. Now, instead of considering the nodes x_i as equally spaced, we use the Chebyshev nodes, defined as

$$x_i = \cos\left(\frac{(2i-1)\pi}{2n}\right), \quad i = 1, 2, \ldots, n \tag{1}$$

The formula in (1) gives nodes that lie on $[-1, 1]$ (and note that they are in decrescent order on the x-axis). If we have a given interval in general form $[a, b]$, then we need to define the Chebyshev nodes via a transformation:

$$x_i = \frac{(a+b)}{2} + \frac{(b-a)}{2}\cos\left(\frac{(2i-1)\pi}{2n}\right), \quad i = 1, 2, \ldots, n \tag{2}$$

Problem 1)

Repeat problems **1.1** and **1.3** from Lab 5 Assignment, by first finding the Chebyshev nodes on the given intervals. Again, plot the polynomial you obtained, the actual function given $f(x)$, and the data points in the same figure, and answer the same questions about the error. Compare with the results obtained with the equi-spaced nodes in Lab 5 and comment about your results.

Always remember to answer all questions, to significantly discuss your results, comment your code, and put labels, title and legend in your figures to obtain full credit for your work.