Labwork Set # 3 – Math 371 – Fall 2009 Due date: midnight, 10/5/2009

1. [2 points each scheme] Write 1 MATLAB function that takes in a data set of n points, a vector of x-values $< a_0, a_1, \ldots, a_i >$, and the interpolation type, and returns a vector of the values of the interpolating polynomial at those x's (i.e. $< P(a_0), P(a_1), \ldots, P(a_i) >$) and the graph of $P(x)$ over $[x_1 - h_1, x_n + h_{n-1}]$. The interpolation types should include

   (I) full-degree polynomial interpolation

   (II) piecewise linear interpolation polynomial

   (III) shape preserving piecewise cubic interpolation (with the end conditions given in the “pchipend” function on page 107)

   (IV) cubic spline with the “not a knot” end conditions given in class

   Make sure that your code generates some kind of warning message in the case that your interpolation might not be accurate (for example, if you use the Vandermonde matrix to find the full-degree polynomial interpolation, you should compute the condition number of the matrix to see whether or not there is concern).

2. Run your code from number 1 for the following data sets

   (a) $\{(1, 4), (2, 4), (3, 4), (6, 4)\}$

   (b) $\{(0, .45), (1, 1.57), (3, -2.66), (4, -5), (5, 0.11), (6, 6)\}$

   (c) $\{(1, 2.2), (2, 8.8), (3, 19.8)\}$

   For each data set you should:

   1.[6 points] generate a **single** MATLAB graph with all four interpolants plotted together. (you can do this by typing the commands “figure” (enter), “hold on” (enter) at the prompt before running your code four times for each data set. Make sure that each interpolant is marked by a different symbol and that you explain which interpolant is connected to which symbol. Save the graph as a fig file titled “371_Labwork3_prob2(a or b).fig”. These three graphs should be handed in.

   2.[6 points] check that the interpolating polynomials actually pass through the given data using the feature of the function from problem 1 that it can take in a set of x-values and return the polynomial values at those x's.