EP501: NUMERICAL METHODS FOR ENGINEERS AND SCIENTISTS
Fall 2017, J. B. Snively

ERAU Daytona Beach
Midterm Exam/Assignment, Due: Thursday, 11/2, *Promptly* by 2:00 PM.

For this project... Understand and implement numerical methods (in Matlab) for polynomial approximations and interpolations of simple data sets.

Absolutely no collaboration is allowed for this assignment – *Your work must be entirely your own, with the only references allowed being your (1) textbook, (2) Matlab's internal help and documentation, and (3) the course website.* Please reference these three allowable sources with page numbers, URLs, or descriptions of how obtained from Matlab's "doc" or "help".
Submission Instructions: The entire assignment must be submitted as a published Matlab script, each problem embedded within a separate (runnable) section, with resulting PDF file and .m file to **snivelyj@erau.edu**, with the subject "EP501: Midterm, Last Name, First Name".

1) Referring to your textbook homework problems and Table 1 (Page 244), obtain the results of the following problems in a single Matlab file section (including comments).
  a. Solve 16 (e) with a direct fit polynomial (solving a system w/ Vandermonde matrix).
  b. 26, to solve only 16 (e) via Neville's algorithm.
  In your comments, discuss and compare these results.

2) Using the entire set of data (both C_p and h) in Table 3, use the Matlab "spline" function to generate a cubic spline fits to these data points.
Plot the following on a single axis for the range of $1000 \le T \le 1600$:
  a. The data points as circles, for both C_p and h.
  b. Your resulting splines, for both C_p and h.
  In your comments, discuss any assumptions made by you or by Matlab in the determination of this spline.

Next, using the entire set of data (both C_p and h) in Table 3, use Matlab "polyfit" function to generate a polynomial fit to the data points. (Use separate figure from Parts **a** and **b**.)
Plot the following on a single axis for the range of $1000 \le T \le 1600$:
  c. The data points as circles, for both C_p and h.
  d. Your resulting functions for 4 polynomials of different degrees of your choice.
  In your comments, discuss the appropriateness of the different polynomials that you have chosen, and what assumptions you (and polyfit) have made.

3) Develop least-squares solutions for linear and quadratic fits to the enthalpy (h) data in Table 3 (Page 245) in Matlab, to *plot the following on a single axis for the range $1000 \le T \le 1600$:*
  a. The data points as circles.
  b. Your resulting function fits for a line to data from $1000 \le T \le 1400$ (not 1600).
  c. Your resulting function fits for a quadratic polynomial to data from $1000 \le T \le 1400$.
  In your comments, detail how you have set up and obtained your solutions, and discuss the appropriateness of the resulting fits for the particular data.