CS 514/ Math 514 Numerical Analysis
Spring 2018
Homework 5
Given: March 29, 2018; Due: **April 5, 2018** 11:45 A.M. (15 minutes before class).
Note that you have only one week to do this HW.

You are permitted to discuss these problems with **one** other student, and you should indicate the name of your collaborator in your answer to the first problem in this set. If you worked on your own, please indicate this on your answer. You should write up your own solution, and you are not permitted to either share a written copy of your solution or copy some one else's written solution. Similarly with programs, you are not permitted to share your code with another student. If you need help with debugging your code, you should describe what the problem is without sharing or showing your code to another student. If you are stuck on a problem or on a code, you could ask the TAs for help on Piazza. Please do not discuss solutions to the HW problems on Piazza before they are graded.

If you copy someone else's work, or let your work be copied, you will get zero points for the entire HW, a loss of one letter grade in the course, and you will be reported to the Dean of Students. I follow the course policies described by Professor Gene Spafford (of Purdue Computer Science department) at the URL `http://spaf.cerias.purdue.edu/~spaf/cpolicy.html` If you are not familiar with this policy, please read it! Please submit your assignments using Blackboard, preferably using either a Tex-generated or Word document.

0. If you collaborated with a student in answering these questions, please write down your collaborator's name. If you did not collaborate with anyone, please indicate that too.

1. Textbook, Chapter 6, Problem 3. Add 5%, 10%, and 30% error to the data points. You can do this by updating each component of the data vector $\mathbf{y}$ as

$$y(i) = y(i) * (1 + c * \mathrm{rand}),$$

   where $c = 0.05$, 0.1 and 0.3. Approximate the data using an interpolating polynomial of degree 32, a cubic spline, and a cubic polynomial that fits the data in the least-squares sense (we had done the third approximation scheme in lecture using the Matlab command `polyfit`). Plot the computed approximations as in Figure 6.4 in the text by sampling the approximating polynomials at a 1000 points in $[0.5\ 4.5]$. Plot the data also in the same graph. Submit your plots. Compute the maximum difference between the value of the approximating least-squares cubic and the data at the input points. Comment on how well the three methods fit the data.

2. Textbook, Chapter 10, Problem 22.

3. Textbook, Chapter 10, Problem 23.

4. Textbook, Chapter 11, Problem 3.