Math 174 Midterm 2

November 20, 2013

- Please put your name, ID number, and sign and date.
- There are 4 problems worth a total of 100 points.
- Calculators are allowed but **you must show your work to receive credit**.

Print Name: _____

Student ID: _____

Signature and Date: _____

Problem	Score
1	/25
2	/25
3	/25
4	/25
Total	/100

1. (25 pts) Given n data points $(x_i, y_i), i = 1, \ldots, n$, **Newton's form** for the interpolating polynomial p generally takes the form:

   $$p(x) = C_1 + C_2(x - x_1) + C_2(x - x_1)(x - x_2) + \ldots + C_n(x - x_1)(x - x_2) \cdot \ldots \cdot (x - x_{n-1})$$

   for some divided differences $C_i, i = 1, \ldots, n$. Suppose we place the nodes x_i in a column vector x and the divided differences C_i in a column vector C. Now given the following header for a Matlab function:

   function [p] = Newtonform(x,C,n,z)

   complete the function so that it returns $p(z)$.

2. (25 pts) Find and write out the matrices P, L, U such that $PA = LU$ is the **PLU factorization** when

$$A = \begin{bmatrix} 1 & -1 & 1 \\ -4 & 0 & 2 \\ 2 & -2 & -1 \end{bmatrix}.$$

3. (25 pts) Count, as efficiently as you can, the **number of flops** needed to solve $LUx = b$, where $A = LU$ is the LU factorization of a $n \times n$ nonsingular, **tridiagonal** matrix A. (Make sure you reduce the count due to 0's and 1's)

4. (25 pts) Determine necessary conditions on a, b for Jacobi method to converge for **any initial guess** when applied to the linear system $Ax = b$ with

$$A = \begin{bmatrix} a & c \\ c & a \end{bmatrix}.$$