Mid term exam: ***CMSC/AMSC/MAPL 460 Computational Methods*** ***10/18/2005***

75 minutes.

1. Problem on number representation removed from online ... (15 points)

2. For a matrix A of size 40×30 a matrix B of size 30×30 and a vector x of size 30, write down the number of operations needed to perform $A(Bx)$ *and* $(AB)x$. Will the answers be the same in each case? (10 points)

3. Write brief descriptions of the following. In each case provide any pertinent details such as formulae, but be brief: (5 points each)
   a. well posed and well-conditioned problems
   b. golden-search for minimization
   c. Why does the order of accessing matrix elements affect the efficiency of software?
   d. Cramer's rule
   e. Why is solving a system of equations by computing the inverse and then multiplying it by the right hand side usually a bad idea?
   f. The differences between cubic Hermite splines, cubic natural splines, and the shape-preserving cubic splines.
   g. Permutation matrix

4. Write a Matlab script that will use Horner's rule to evaluate:
   $a_1 + a_2 (x-x_1) + a_3 (x-x_1) (x-x_2) + a_4 (x-x_1) (x-x_2) (x-x_3)+\ldots$ (15 points)

5. Write down the Lagrange form of the interpolating polynomial for the data $(x; f(x)) = (4,-5),(7,2), (9,3)$. Evaluate this polynomial at $x=5$. (10 points)

6. Let $f(x)=x^3-27=0$. Perform two iterations each using the (15 points)
   a. Bisection method, with a starting interval of [0,5]
   b. Secant method with starting values of x_1 =1 and x_2 =2.
   c. Newton's method with a guess of $x=2$