CS 417

Midterm Exam

You have until 11:59 PM Monday the 2nd of November to submit your exam on blackboard. It is open web/notes/book but you must use your own software that you wrote for this class where indicated. You may not discuss the contents of this exam with anyone else until Tuesday the 3rd.

1. Use your software to find the dominant eigenvalue and the associated eigenvalue for the following matrix.

(9 | 1 | 3 | 4 | 3 | 1
3 | 11 | 5 | 1 | -1 | 2
1 | 1 | 15 | 1 | -2 | 1
2 | 0 | 1 | 3 | 18 | 1
2 | 1 | 4 | 5 | 16 | 2
1 | -2 | 1 | -2 | 1 | 11)

1. Use your Newton’s Root Solver to find a zero for 3x^3 - 15cos(x) + 3ln(x) + 2sin(x) = 0

Use 0.5 as a first estimate then display the progression of your solution to the 4th decimal place.

1. Use your LU Solver to find the solution to the matrix problem labeled q3data.txt. Convert the solution vector to a square domain and plot the surface described by that in either excel or gnuplot. Submit your surface plot of the solution.
2. Modify your Jacobi solver so that the user can input the number of iterations performed (it should stop if the solution to 6 decimal places is found before the iterations are complete.) Solve the matrix problem labeled q4data.txt but input the number of iterations as powers of 2 until the solution is found. So you will solve the problem with 2 iterations with a random starting vector, plot the solution. Then again with 4 iterations and plot, then again with 8 iterations..etc..Submit ALL graphs of your solutions, this should give a step by step evolution of the solution.
3. Using ONLY backwards finite difference approximations for the first derivatives derive and write out the following finite differences assuming dx = dy = .1
4. Write out enough of the matrix based on this equation to show the structure of it.

Use standard approximations for the second derivative and forward differences for the first derivative. The grid is a unit square with boundary conditions Q = row number k for even values of k and Q = -(row number k) for odd values of k. Nx = 9, Ny =6.