EE 222 – Homework 4

(Due November 8, 2011, 12:45pm)

1. Write a function `GaussJordan` that will solve the given system of equations using the Gauss-Jordan Method. ***(50)***

2. Write a function `GaussSiedel` that will solve the given system of equations iteratively, using the Gauss-Siedel Method. The algorithm is attached below. ***(50)***

ALGORITHM GAUSS–SEIDEL ($\mathbf{A}$, $\mathbf{b}$, $\mathbf{x}^{(0)}$, ϵ, N)

This algorithm computes a solution $\mathbf{x}$ of the system $\mathbf{A}\mathbf{x} = \mathbf{b}$ given an initial approximation $\mathbf{x}^{(0)}$, where $\mathbf{A} = [a_{jk}]$ is an $n \times n$ matrix with $a_{jj} \neq 0$, $j = 1, \cdots, n$.

INPUT: $\mathbf{A}$, $\mathbf{b}$, initial approximation $\mathbf{x}^{(0)}$, tolerance $\epsilon > 0$, maximum number of iterations N

OUTPUT: Approximate solution $\mathbf{x}^{(m)} = [x_j^{(m)}]$ or failure message that $\mathbf{x}^{(N)}$ does not satisfy the tolerance condition

For $m = 0, \cdots, N-1$, do:

For $j = 1, \cdots, n$, do:

1 $$x_j^{(m+1)} = \frac{1}{a_{jj}}\left(b_j - \sum_{k=1}^{j-1} a_{jk} x_k^{(m+1)} - \sum_{k=j+1}^{n} a_{jk} x_k^{(m)}\right)$$

End

2 If $\max_j |x_j^{(m+1)} - x_j^{(m)}| < \epsilon\, |x_j^{(m+1)}|$ then OUTPUT $\mathbf{x}^{(m+1)}$. Stop

[*Procedure completed successfully*]

End

OUTPUT: "No solution satisfying the tolerance condition obtained after N iteration steps." Stop

[*Procedure completed unsuccessfully*]

End GAUSS–SEIDEL

EXTRA CREDIT

3. Write a function `determinant` to find the determinant of an n×n matrix using recursion. ***(10)***