**2014 Numerical Analysis Final Examination, 100 points**

1. Assume the coefficient matrix *A* and the right hand side *b* of a linear system are defined as:.
   1. Eliminate the linear system into an upper-triangular system by using Gaussian elimination method. (15)
2. LU-Decompose the matrix A of Problem 1 into a lower triangular matrix L and an upper triangular matrix U. (15)
3. Solve the linear system of Problem 1 by using Gauss-Seidel method. Selecting the initial solution, , compute and . (10)
4. Solve the linear system of Problem 1 by using SOR method. Assume the initial solution and . Compute and . (10)
5. Solve the linear system of Problem 1 by using Steepest Descent method. Assume the initial solution . Compute the gradient of the quadratic form, the optimal descent step size , and the new solution . (10)
6. Compute the most significant eigenvalue and eigenvector of the matrix A of Problem 1 by using the Power method. Selecting , modify the eigenvector and compute the eigenvalue. (Just iterate once.) (10)
7. Answer the following questions about inverse power method: (10)
   1. Briefly describe the purpose of inverse power method.
   2. Without computing , how do we perform the matrix-vector multiplication?
8. Compute the eigenvalues and eigenvectors of Matrix A by using Jacobi method.(20)
   1. Which entry should be eliminated first?
   2. Compute the rotational matrix R.
   3. Compute the similarity transformation