**2018 Fall Semester, Numerical Analysis, Final Exam**

每一題的主要計算過程都要列出，只寫出答案得0分。先寫第9題!

1. A linear system is defined as follows:

. (a) Using Doolittle’s LU-decomposition method compute L and U. (b) Solve by using forward substitution. (10%)

1. Convert the linear system of Problem 1 into an upper triangle system by using QR-decomposition. For each column of the coefficient matrix: (a) Deduce the reflection vector *v* and use the revised method to eliminate the column. (b) Write down matrix **A** after the elimination. (15%)
2. Solve the linear system of Problem 1 by using Gauss-Seidel method. Assuming that , compute . (10%)
3. Solve the linear system of Problem 1 by using SOR method. Assuming that ω=1.5, and , compute . (10%)
4. Solve the linear system of Problem 1 by using Conjugate Gradient Method using (15%)
   1. Perform 2 iterations to compute .
   2. For each iteration, compute *d, g, α, β*, and *x*.
5. Given the matrix **A** as shown in Problem 1, compute the maximum eigenvalue and its associated eigenvector by using Power Method. Perform the iteration 2 times by using . In each iteration, compute the normalized eigenvector *y* and vector *x* and eigenvalue. (10%)
6. Compute the minimum eigenvalue and its associated eigenvector of matrix **A** by using the inverse power method. Perform the iteration once. Please use the same initial eigenvector. List each key step, including solving the LU system, vectors *y* and *x* and the eigenvalue. (10%)
7. Compute the eigenvalues and eigenvectors of matrix **A** by using Jacobi method. Perform the iteration once and list the max off-diagonal entry, theta, and matrices **A** and **P**. (10%)
8. Compute the 2-norm, 1-norm, and ∞-norm of matrix **A** and vector *b* of problem 1. (10%)