**Scientific Computing Final Examination, year 2011**

1. (a) Write down the definition of condition number. (b) There is a linear system AX=b, and b is polluted such that it becomes b’ = b + Δb. Please deduce the relative error of X. (10%)
2. Use Gaussian elimination to solve the following linear system: (15 %)

.

* 1. You have to perform partial pivot, if necessary.
  2. Please write down the triangular system of the forward elimination.
  3. Please list the final solution.

1. Compute the solution of the linear system of Problem 2 by using Gauss-Seidel method. Assume the initial guess is . (15%)
   1. Write down the algorithm and explain it briefly.
   2. Compute X(1)=?
   3. Compute X(2) = ?
2. Use SOR method to solve the following linear system. (15%) .
   1. Please write down the formulation of SOR method and explain the relation between SOR and Gauss-Seidel method.
   2. Compute X(1) and X(2).
3. Decompose the coefficient matrix of the previous problem into A = L\*U, where L and U are a lower and an upper triangular matrices. (15%)
4. Use the power method to compute the major eigen vector and eigen value of the coefficient matrix of Problem 4. (15%)
   1. Compute Y(1) and Y(2), assume that Please also update the major eigen value at each iteration.
5. Please eliminate the off-diagonal entry A[0][1]=2 of the coefficient matrix of problem 4 by using Jacobi’s method for computing the eigen values. (15%)
   1. Please deduce the rotational matrix step by step.
   2. Please compute the similarity transformation.