

MATH 365 Homework #11

Due: Wednesday, May 2, 2012

Given the following coefficient matrix

$$A = \begin{pmatrix} 4 & 2 & 0 \\ 2 & 10 & 4 \\ 0 & 4 & 5 \end{pmatrix},$$

and the right-hand-side vector

$$b = \begin{pmatrix} 2 \\ 6 \\ 5 \end{pmatrix}.$$

1. (50 points) Based on SOR iterative method, **write and run a real source code on the computer** to solve the linear system $Ax = b$ for x , where you shall use different values for the parameter ω to test your code, say, $\omega = 0.5, 0.8, 1.3, 1.6, 1.9$ and 2 , and compare the obtained corresponding solutions x with the solution of Question 1 to know about the optimal ω .

Note that by theorem, SOR method may not converge if $\omega \geq 2$, check it out using your code as well.

Please show the number of iteration for each chosen ω for a given tolerance ε , say, $\varepsilon = 10^{-6}$. The optimal ω always gives the smallest number of iteration.

2. Given a matrix A as follows

$$A = \begin{pmatrix} 4 & 2 \\ 15 & 5 \end{pmatrix}.$$

(2.1) (30 points) Find the eigenvalues and the corresponding eigenvectors of the above matrix A .

(2.2) (20 points) Find the spectral radius and condition number of the above matrix A .

Note: In your homework, the right source code and the correct output results must be shown altogether in order to obtain full score.