

# MATH 566 – Final Examination

due 18 December 2007 at 1730

Collaboration with other class members is forbidden, as is seeking help from people not in this class. However, you are free to use your text, class notes, other books, internet sites, etc. If you use other books or internet sites, you must provide appropriate citations to avoid accusations of plagiarism. GOOD LUCK!

1) Do the following exercises from the text: 1.4.58, 2.2.23, 3.2.64, 4.1.5, 4.1.6, 4.1.11, 4.1.13 or 4.1.14, 4.1.15, 4.2.5, 5.6.2, 5.6.6.

2) Let  $A$  be a real  $n \times n$  symmetric matrix. What is the relationship between its singular values and its eigenvalues? Prove your result.

3) Write a computer program in Matlab to implement the QR method (with shifting and deflation) to find eigenvalues of an  $n \times n$  matrix  $A$ . The data about  $A$  should be read from a file called `fex.in`, whose structure in the following order is:

- the size  $n$  of the matrix
- the real part of  $A$ , row by row
- the imaginary part of  $A$ , row by row

The output of your program should be written to a file called `fex.out`. This file should first list the eigenvalues. Following these, the eigenvectors should appear as column vectors, given in the same order as their respective eigenvalues.

We will not discuss in class how the eigenvectors are obtained; you need to either research this or figure it out on your own. Include a description of how you produced the eigenvectors.

You may assume that your matrix  $A$  is sufficiently “nice”, in the sense that it will have no two eigenvalues of equal magnitude.