1. Text, 2.1

2. Text, 2.2, part a only

3. Text, 4.1b,c,e

4. Text, 4.3 (this is a Matlab assignment). (You only need to apply your algorithm to matrices in 4.1b,c,e). You may use the built-in Matlab svd function (type `help svd` to see how to use it).

5. Let $A$ be a square, real, symmetric matrix, and assume the singular values of $A$ are distinct. Using the facts $A = U\Sigma V^T$ and $A^T = V\Sigma U^T$, prove that $u_i = \pm v_i$, where $u_i$ and $v_i$ are the columns of $U$ and $V$, respectively. (This means that for a symmetric matrix with distinct singular values, the SVD yields an eigendecomposition of $A$!)

Math 250NLA, Homework 2
Due Sept. 22, 2005

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4. Text 4.2

5. Text 3.5. You may wish to consider what the reduced SVD of $E$ would be, and use the invariance of the Frobenius norm.

6. Consider the matrix

$$A = \begin{bmatrix} 1 & 2 \\ -1 & -2 \\ 3 & 6.001 \end{bmatrix}.$$  

Use Matlab to determine the singular values of this matrix. How many orders of magnitude different are the singular values? What does the hyperellipse onto which $A$ maps the singular vectors $v_i$ look like?

Next, change $A(3,2) = -4$. Compute the singular values of this matrix. They shouldn’t be as disparate in magnitude, so the hyperellipse in this case takes on a different shape. What accounts for the difference in the singular values of the first matrix vs. the second matrix? (Hint, compare the columns of the first matrix to each other; then, compare the columns of the 2nd matrix to each other.)