1. (a) #13; Section 4.10; p. 233: Write a MATLAB function to find the singular value decomposition of a matrix $A$ using only functions designed to compute eigenvalues and eigenvectors of matrices. That is, you can use functions such as eig, powerit and QRit, but do not use the built-in function svd.

(b) Use your MATLAB function in (a) to find the singular value decomposition of the matrix $A = \begin{bmatrix} 3 & 9 & 3 \\ 1 & 7 & 5 \\ 1 & 7 & 5 \\ 3 & 9 & 3 \end{bmatrix}$. This means find matrices $\Sigma$, $U$ and $V$, such that $A = U\Sigma V^T$.

(c) Find an orthogonal matrix $Q$ and a diagonal matrix $D$ such that $AA^T = QDQ^T$, without calculating $AA^T$.

(d) Find an orthonormal basis for (i) the left nullspace of $A$ and (ii) an orthonormal basis for the nullspace of $A$, using your answer to part (b).

(e) Find the orthogonal projection of $b = \begin{bmatrix} 54 \\ 0 \\ 36 \\ 72 \end{bmatrix}$ onto the column space of $A$. 

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