

## Math 227 Assignment 8

Due Thursday, April 19

1) For each of the following matrices,

i) Find  $A^t A$ .

ii) Orthogonally diagonalize  $A^t A$  and record the eigenvalues.

iii) Find the full singular value decomposition of  $A$  and record the singular values. Compare them to the eigenvalues of  $A^t A$ .

iv) Find the score matrix  $T$  and record the first principal component of each matrix.

a) (8 points)  $\begin{bmatrix} 3 & 2 \\ 2 & 3 \\ 2 & -2 \end{bmatrix}$

b) (12 points)  $\begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

2) (5 points) Let  $A$  be an arbitrary  $1 \times 2$  vector. Show that the *nonzero* singular value of  $A$  is equal to the 2-norm of  $A$ . (This hints at a more difficult fact to prove, which is that the nonzero eigenvalues of  $A^t A$  are equal to the nonzero eigenvalues of  $AA^t$ ).