1. Find a least-squares solution $\widehat{x}$ to the equation $Ax = b$ for

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix} \text{ and } b = [1 \quad 3 \quad 8 \quad 2]^T.$$

Is $\widehat{x}$ unique? If yes, prove it. If no, give a description of *all* least-squares solutions to $Ax = b$.

2. Let

$$A = \begin{bmatrix} 1 & 5 \\ 3 & 1 \\ -2 & 4 \end{bmatrix} \text{ and } b = [4 \quad -2 \quad -3]^T.$$

Compute the projections of b onto Col(A). Is it possible to compute the projection of b onto Row(A)?

3. Section 6.7, exercise 1 from the book (page 300).

4. Let $A = \begin{bmatrix} 5 & -4 & -2 \\ -4 & 5 & 2 \\ -2 & 2 & 2 \end{bmatrix}$. Verify that $v_1 = [-2 \quad 2 \quad 1]^T$ and $v_2 = [1 \quad 1 \quad 0]^T$ are eigenvectors of A. Orthogonally diagonalize A.

5. Construct a spectral decomposition for the matrix A of exercise 4.