**M353 4.1 LS** (S. Zhang) .

1. (4.1:a1) Find the least-squares solution for the over-determined system. Compare the residual for the least-squares solution with "solutions" (1) $(0,0)$, (2) $(1,1)$.

$$\begin{pmatrix} 1 & 1 \\ 1 & 0 \\ 2 & -3 \end{pmatrix} x = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}.$$

2. (4.1:a2) Find the least-squares solution for the under-determined system. Compare the length for the least-squares solution with solutions (1) $(14,0,28)$, (2) $(0,70/3,70/3)$, (3) a solution found by Gauss elimination.

$$\begin{pmatrix} 1 & 1 & 2 \\ 1 & 0 & -3 \end{pmatrix} x = \begin{pmatrix} 70 \\ -70 \end{pmatrix}.$$

3. (4.1:a3) Find the least-squares solution each problem.

$$\begin{pmatrix} -2 & -1 \\ 1 & 1 \\ 3 & -1 \end{pmatrix} x = \begin{pmatrix} 7 \\ 0 \\ 14 \end{pmatrix}, \quad \begin{pmatrix} -2 & 1 & 3 \\ -1 & 1 & -1 \end{pmatrix} x = \begin{pmatrix} 21 \\ 9 \end{pmatrix}.$$