Solution (#927) (i) The matrix

$$\begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix}$$

is singular and diagonalizable.

(ii) The matrix

$$\begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix}$$

is invertible and diagonalizable.

(iii) Either of the matrices from (i) and (ii) would suffice as upper triangular matrices which are diagonalizable.

(iv) The matrix

$$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{pmatrix}$$

is singular, not diagonalizable over $\mathbb{R}$ but is diagonalizable over $\mathbb{C}$.